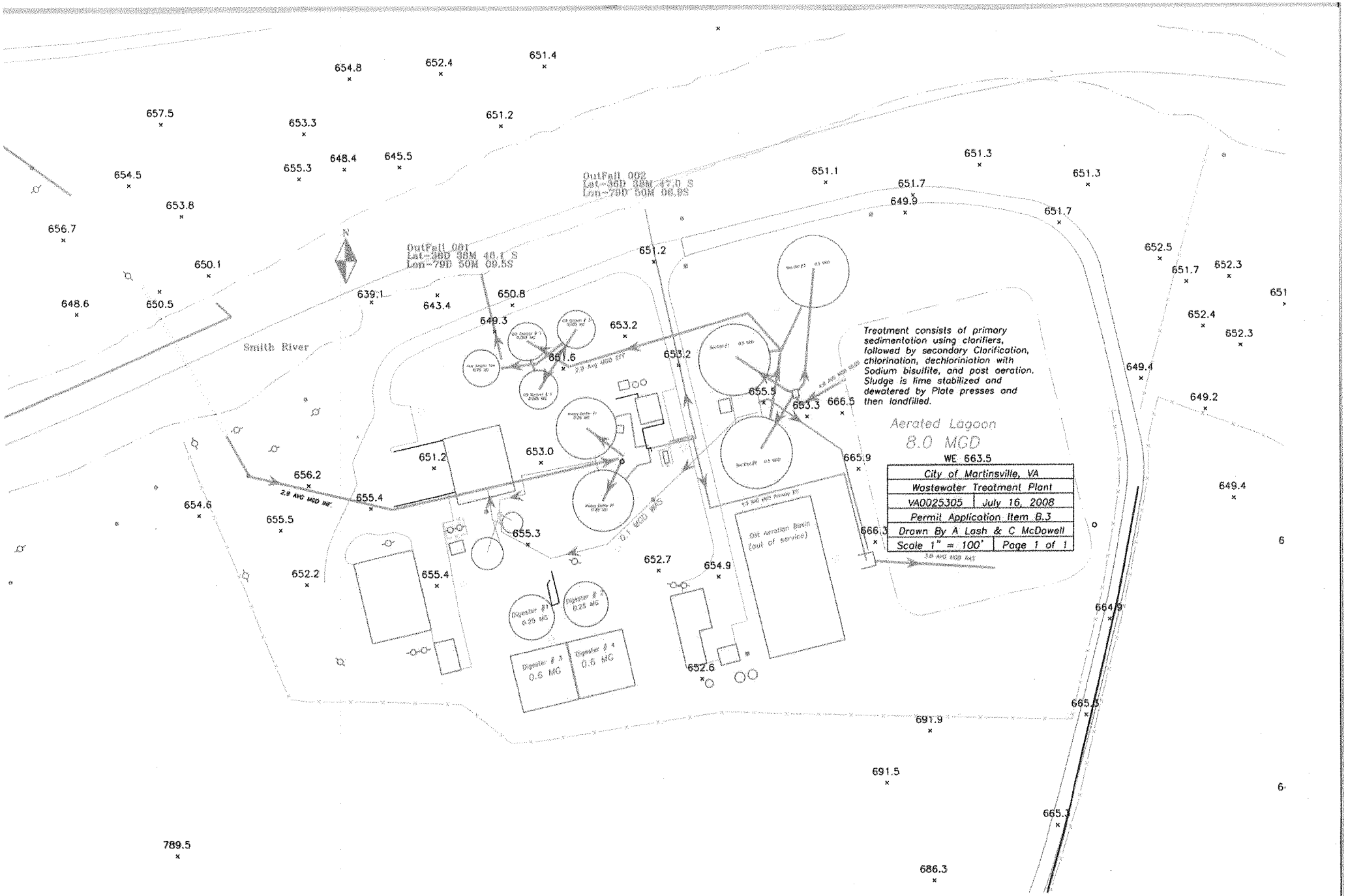
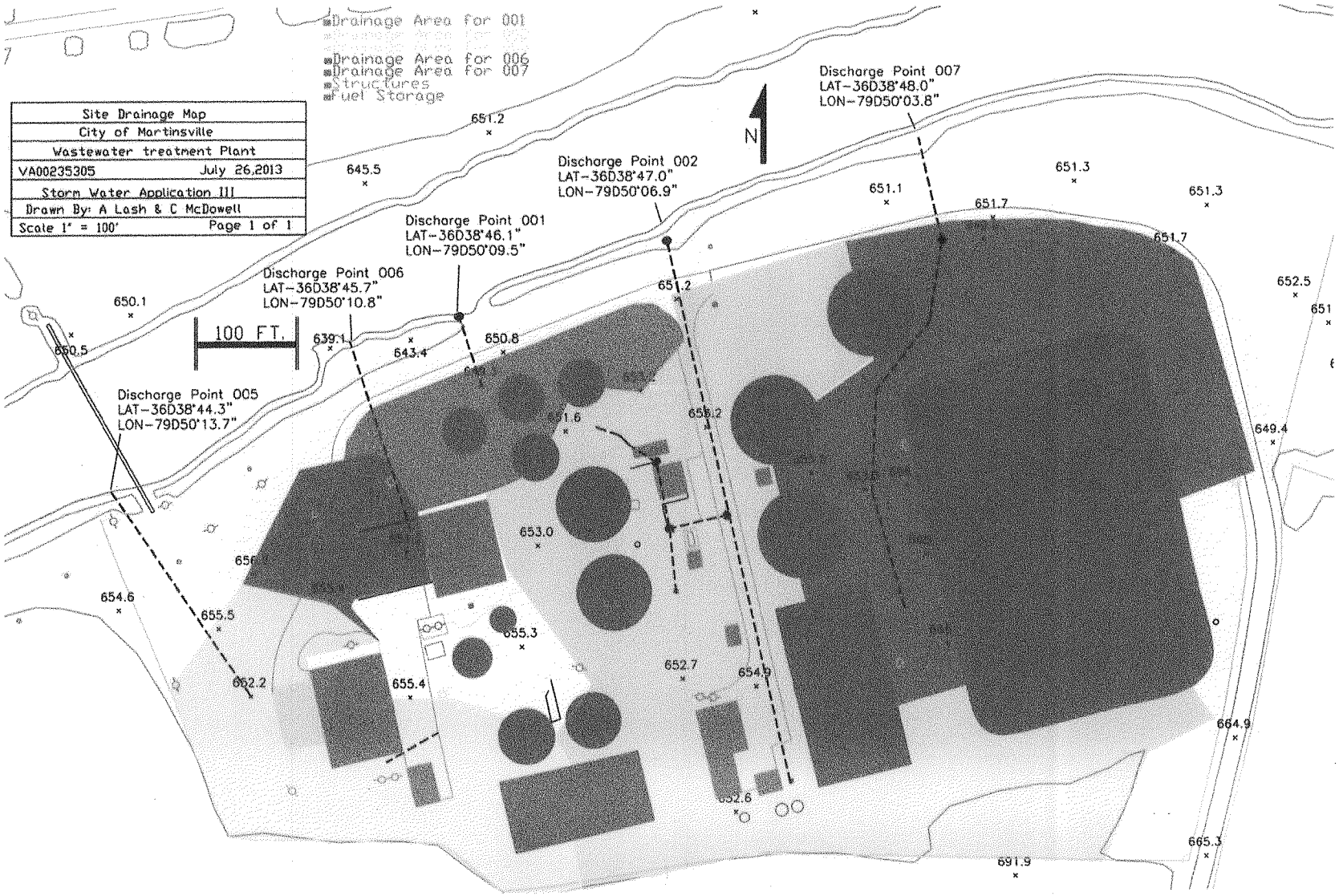
Attachments

A. Wastewater Treatment Diagrams
B. USGS Topographic Map
C. Flow Frequency Memorandum
D. Site Visit Report
E. Ambient Water Quality Information
   - 2012 Impaired Waters Report (Excerpt)
   - Dan River TMDL Report (Excerpt)
   - STORET Data (Station 4ASRE022.71)
F. Wasteload and Limit Calculations
   - Mixing Zone Calculations (MIXER)
   - Daily Effluent pH Data
   - Wasteload Allocation Spreadsheet
   - STATS Program Results
   - Regional Model Output
G. Historical Limit Development
H. TMP Justification Memorandum

Attachment A

Wastewater Treatment Diagrams


OutFall 002
Lat=36D 38M 43.0 S
Lon=79D 50M 08.0S
OutFall 001
Lat=36D 38M 46.1 S
Lon=79D 50M 09.5S
N
Smith River
Treatment consists of primary sedimentation using clarifiers, followed by secondary Clarification, chlorination, dechloriniation with Sodium bisulfite, and post aeration. Sludge is lime stabilized and dewatered by Plate presses and then landfilled.
Aerated Lagoon
8.0 MGD
WE 663.5
City of Martinsville, VA
Wastewater Treatment Plant
VA0025305 July 16, 2008
Permit Application Item B.3
Drawn By A Lash & C McDowell
Scale 1" = 100' Page 1 of 1
Old Aeration Basin (out of service)
Digester # 1 0.25 MG
Digester # 2 0.25 MG
Digester # 3 0.6 MG
Digester # 4 0.6 MG
2.9 AVG MGD WF.
0.7 MGD WAS
2.9 AVG MGD EFF
4.8 AVG MGD RAS
3.8 AVG MGD RAS


Drainage Area for 001
Drainage Area for 006
Drainage Area for 007
Structures
Fuel Storage
Site Drainage Map
City of Martinsville
Wastewater treatment Plant
VA00235305 July 26,2013
Storm Water Application III
Drawn By: A Lash & C McDowell
Scale 1" = 100' Page 1 of 1
N
100 FT.
Discharge Point 001
LAT-36D38'46.1"
LON-79D50'09.5"
Discharge Point 002
LAT-36D38'47.0"
LON-79D50'06.9"
Discharge Point 005
LAT-36D38'44.3"
LON-79D50'13.7"
Discharge Point 006
LAT-36D38'45.7"
LON-79D50'10.8"
Discharge Point 007
LAT-36D38'48.0"
LON-79D50'03.8"
651.2
645.5
651.1
651.3
651.7
650.1
650.5
639.1
643.4
650.8
652.5
649.4
653.0
654.6
655.8
655.3
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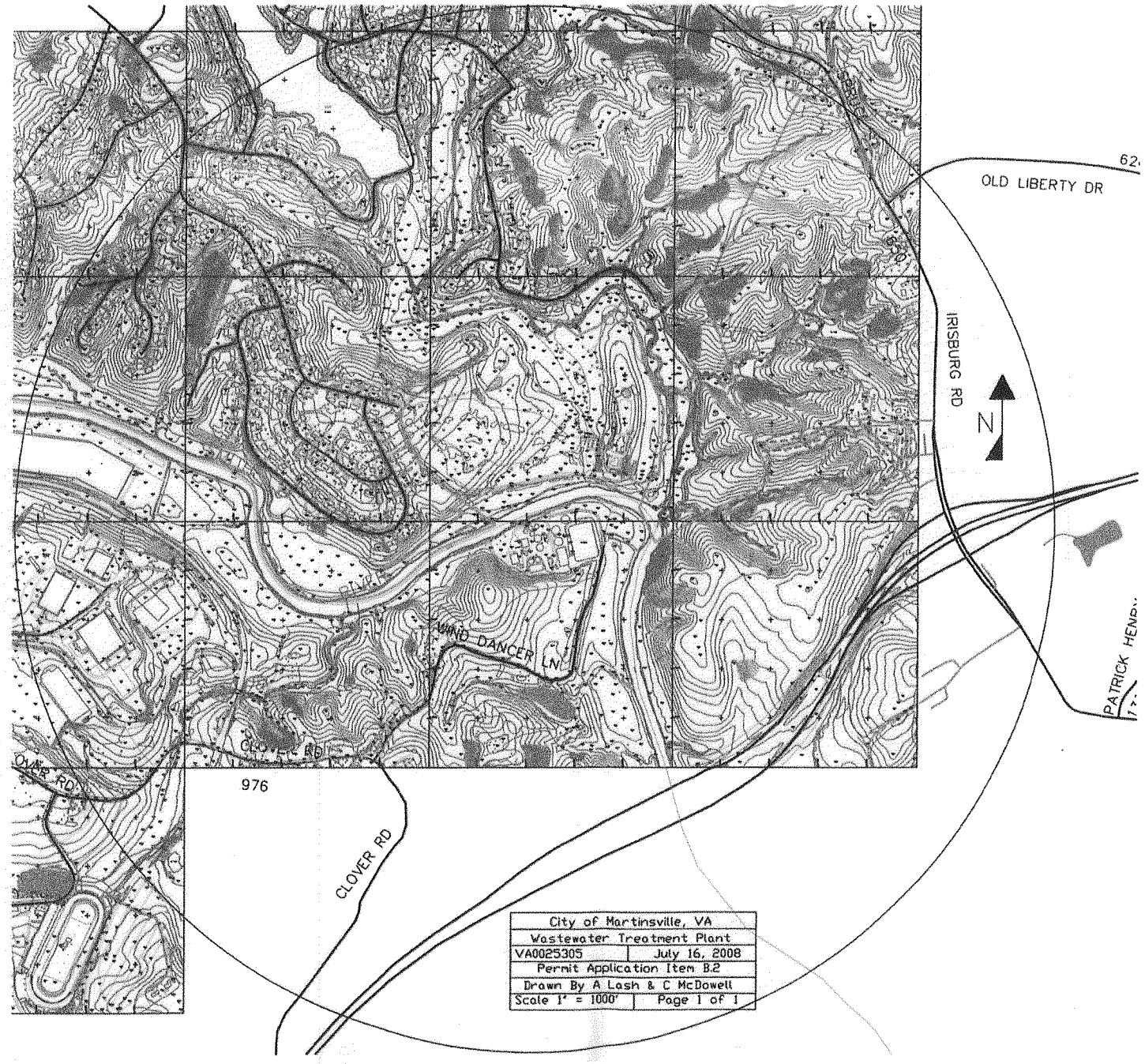
655.4
652.7
654.6
664.9
652.6
665.3
691.9

Attachment B

USGS Topographic Maps



City of Martinsville, VA	
Wastewater Treatment Plant	
VA0025305	July 16, 2008
Permit Application Item B.2	
Drawn By A Lash & C McDowell	
Scale 1" = 1000'	Page 1 of 1

Attachment C

Flow Frequency Memorandum

MEMORANDUM

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

WEST CENTRAL REGIONAL OFFICE

3019 Peters Creek Rd. Roanoke, VA 24019

SUBJECT: Flow Frequency Determination
Martinsville STP - #VA0025305

TO: Permit File

FROM: Kevin Harlow

DATE: December 30, 2008

COPIES: Kevin Harlow

The Martinsville STP discharges to the Smith River near Martinsville, VA. Flow frequencies are required at these sites for use in developing effluent limitations for the VPDES permits.

The USGS and VDEQ have operated continuous record gages on the Smith River; one near Philpott, VA (#02072000), one near Bassett, VA (#02072500), and one at Martinsville, VA (#02073000) (VDEQ gage). The gages are in close proximity to the discharge points. The three gages were used in accordance with the procedure outlined in Charles Martin's memo of 2/17/93 to Mike McLeod, Subject: "Low Flow Frequencies for Main Stem Smith River for Calculating TMDL's". In a nutshell, Charles used the regulated record from the Philpott gage for main stem regulated flows below the Philpott Dam; he used the unregulated record from the Bassett gage to estimate flows contributed by the unregulated drainage area between Philpott Dam and Martinsville Dam and below Martinsville Dam to he North Carolina line; and he used the regulated record from the Martinsville gage for main stem regulated flows below the Martinsville Dam. This updated analysis incorporates additional years of regulated data collected at the gages since the earlier analysis.

The flow frequencies for the gages and the discharge points are presented below. The values at each discharge point were determined as described below and do not address any withdrawals, discharges, or springs lying upstream.

Smith River near Philpott, VA (#02072000):

Drainage Area = 216 mi^2

1Q10 = 19 MGD	High Flow 1Q10 = 22 MGD	30Q10 = 46 MGD
7Q10 = 39 MGD	High Flow 7Q10 = 51 MGD	HF30Q10 = 58 MGD
30Q5 = 54 MGD	HM = 74 MGD	

Smith River at Bassett, VA (#02072500):

Drainage Area = 259 mi^2

1Q10 = 32 MGD	High Flow 1Q10 = 37 not contiguous	30Q10 = 65 MGD
7Q10 = 57 MGD	High Flow 7Q10 = 69 not contiguous	HF30Q10 = 75 MGD
30Q5 = 74 MGD	HM = 110 MGD	

Smith River at Martinsville, VA (#02073000):

Drainage Area = 380 mi^2

1Q10 = 23 MGD	High Flow 1Q10 = 35 MGD	30Q10 = 103 MGD
7Q10 = 87 MGD	High Flow 7Q10 = 105 MGD	HF30Q10 = 120 MGD
30Q5 = 118 MGD	HM = 187 MGD	

Smith River at Martinsville STP discharge point:
Flow frequencies are determined by adding flow contributed by intervening drainage area to flows from the Martinsville Dam using the Martinsville gage.

Drainage Area = 390 mi^2
Intervening drainage area = 390 - 380 = 10 mi^2

1Q10 = 23 MGD + [(32-19)/43 * 10)] = <u>25 MGD</u>
7Q10 = 87 MGD + [(57-39)/43 * 10)] = <u>90 MGD</u>
30Q10 = 103 MGD + [(65-46)/43 * 10)]= <u>107 MGD</u>
30Q5 = 118 MGD + [(74-54)/43 * 10)] = <u>122 MGD</u>
High Flow 1Q10 = 35 MGD + [(37-22)/43 * 10)] = <u>38 MGD</u>
High Flow 7Q10 = 105 MGD + [(69-51)/43 * 10)] = <u>108 MGD</u>
High Flow 30Q10 = 120 MGD + [(75-58)/43 * 10)] = 124 MGD
HM = 187 MGD + [(110-74)/43 * 10)] = <u>194 MGD</u>

The high flow months are January through June.

Attachment D

Site Visit Report

Permit #	VA0025305

UNIT PROCESS EVALUATION SUMMARY SHEET

UNIT PROCESS	APPLICABLE	PROBLEMS*	COMMENTS
Wastewater Pumping	X		
Flow Measurement	X		
Screening/Comminution	X		
Grit Removal	X		
Flow Equalization			
Ponds/Lagoons			
Primary Sedimentation	X		
Trickling Filter			
Septic Tank and Sand Filter			
Rotating Biological Contactor			
Activated Sludge Aeration	X		
Sequencing Batch Reactor			
Secondary Sedimentation	X	1	**Weirs need cleaning.**
Flocculation			
Filtration			
Activated Carbon Adsorption			
Chlorination	X	3	**Interior room lights not working.**
Dechlorination	X		
Ozonation			
Ultraviolet Disinfection			
Post Aeration	X		
Land Application (Effluent)			
Plant Outfall	X		
Sludge Pumping	X		
Flotation Thickening (DAF)			
Gravity Thickening	X		
Aerobic Digestion			
Sludge Holding / Lime Stabilization	X		**Holding Tanks #3 and #4 were being cleaned out.**
Centrifugation			
Sludge Press	X		**Two Belt Presses were in use.**
Vacuum Filtration			
Drying Beds			
Land Application (Sludge)			

* Problem Codes

1. Unit Needs Attention
2. Abnormal Influent/Effluent
3. Evidence of Equipment Failure
4. Unapproved Modification or Temporary Repair
5. Evidence of Process Upset
6. Other (explain in comments)

OUTFALL OBSERVATIONS

Outfall #	Condition of Effluent	Condition of Receiving Stream	Samples Collected (Y or N)
002	**A slight clear discharge was noted.**	**Smith River appeared turbid.**	**N**
005	**No discharge**	**Smith River appeared turbid.**	**N**
006	**No discharge**	**Smith River appeared turbid.**	**N**
007	**No discharge**	**Smith River appeared turbid.**	**N**

OUTFALL DISCUSSION:

P.S. 002 **This outfall drains the center of the wastewater treatment plant property between the primary and secondary clarifiers.**

P.S. 005 **This outfall drains the far west side of the property.**

P.S. 006 **This outfall drains the area around the main control building.**

P.S. 007 **This outfall drains the eastern side of the property between the secondary clarifiers and the aerated lagoon.**

DESCRIPTION AND EFFECTIVENESS OF BMPs/CONTROLS USED ON SITE:

The BMPs at this facility are very good.

REQUESTS FOR ACTION:

There are no requests for action related to this inspection.

Attachment E

Ambient Water Quality Information

- STORET Data (Station 4ASRE022.71)
- Dan River TMDL Report (Excerpt)
- 2012 Impaired Waters Report (Excerpt)

Date	Temp Celsius	Field pH	Hardness
6/12/2001	23.1	8.2	13.4
5/15/2001	17.5	7.6	22.4
4/9/2001	18.3	8.2	20.9
3/8/2001	6.4	8	18.3
2/8/2001	7.3	7.9	30.1
1/9/2001	4.1	7.5	22.2
6/21/2000	21.7	6.75	24
5/23/2000	17.9	6.66	29
4/5/2000	12	7.01	24
3/22/2000	10	6.86	22
2/23/2000	6.8	6.7	28
1/12/2000	6.8	6.45	29.1
6/16/1999	16.7	7.8	25.2
5/19/1999	17.2	8.3	26
4/19/1999	12.3	7.63	26
3/29/1999	10.8	7.89	26
2/11/1999	7.9	7.2	48
1/21/1999	6.1	7.63	26
6/24/1998	17.4	8.19	23.5
5/6/1998	11.4	7.23	24.5
4/13/1998	13.9	7.77	24.3
3/17/1998	7.1	7.14	21.6
2/19/1998	7	6.9	22.4
1/20/1998	6.5	7.26	21.8
6/25/1997			24.9
5/14/1997	13.4	7.67	22.6
4/28/1997	10.6	7.46	22.7
3/10/1997	9.8	7.75	21.8
2/19/1997	6.6	7.75	19.7
1/27/1997	4.9	7.62	24.9
6/13/1996	11.5	8.1	12
5/16/1996	12.4	7.7	26
4/17/1996	10.8	6.7	19
3/25/1996	12	7.2	32
2/26/1996	13	7.68	25
1/24/1996	6	6.77	21
6/20/1995	20.5	7.1	22
5/17/1995	16.2	6.93	20
4/18/1995	16.2	7.44	25
3/28/1995	14.5	7.66	22
2/23/1995	6.9	7.83	20
1/25/1995	6.9	7.48	17
6/27/1994	21.2	6.94	22
5/31/1994	19.8	7.6	24
4/28/1994	12.8	7.7	21
3/23/1994	13.2	8	18
2/24/1994	6.8	7.6	18
1/24/1994	4.6	7.6	28
6/28/1993	23	7.7	22
5/20/1993	12.6	7.2	18
4/27/1993	10.5	7.4	20
3/30/1993	8.2	7.5	18
2/10/1993	6.8	8	24
1/26/1993	5	7.7	20
6/16/1992	17.1	7.2	

Date	Temp Celsius	Field pH	Hardness
5/19/1992	12.3	7.4	
4/20/1992	21.6	7.8	28
3/16/1992	5.4	7.4	24
2/12/1992	6.6	7.8	24
6/12/1991	19.8	8.8	12
5/28/1991	19.4	7	20
4/16/1991	11.9	7.9	12
4/11/1991	12.4	6.6	46
2/21/1991	9.5	7.3	22
1/17/1991			
6/25/1990	23.7	7.8	24
5/16/1990	17	8.1	20
4/17/1990	12.8	8	18
3/20/1990	7.3	8.3	20
2/21/1990	6.4	8.9	20
1/31/1990	7.1	8.3	19
6/28/1989	14.4	8.3	
6/28/1989			22
5/24/1989	22.5	8.9	
5/24/1989			22
4/27/1989	18.2	8.1	26
3/30/1989	19.3	7.9	
3/30/1989			24
2/7/1989	8.7	8.4	
2/7/1989			24
1/4/1989	5.8	7.5	
1/4/1989			26
12/7/2000	4.9	7.2	23.7
11/13/2000	10.2	8.8	23.7
10/19/2000	15.3	8.7	25.2
8/7/2000	23.5	7.8	25.1
7/20/2000	21.8	7.5	24
12/8/1999	7.6	7.07	29.6
11/3/1999	12.6	6.51	
10/21/1999	13.1	7.66	26.2
9/27/1999	19.8	7.6	61.2
8/26/1999	15	7.73	24.4
7/27/1999	23.3	7.48	26.7
12/9/1998	13.7	7.43	28
11/23/1998	9.9	8.07	28.7
10/29/1998	14.2	7.29	22
9/3/1998	19.5	7.63	24.4
8/10/1998	22.7	7.12	24.4
7/27/1998	20.9	7.24	27.1
12/11/1997	7	7.18	25.6
11/19/1997	7.4	7.58	25.5
10/28/1997	12.6	7.98	22.8
9/30/1997	18.1	7.67	16
8/21/1997	18.1	7.17	23.7
7/31/1997	17.2	7.75	24.1
12/17/1996	8.2	7.24	24
11/7/1996	15.5	7.3	23
10/21/1996	14.1	7.46	30
9/23/1996	20.4	7.83	30
8/21/1996	18.7	7.53	20

Date	Temp Celsius	Field pH	Hardness
7/24/1996	22.8	7.9	22
12/18/1995	7.4	6.89	27
11/28/1995	9.4	7.02	31
10/30/1995	13.1	7.13	28
9/27/1995	15.5	7.4	24
8/28/1995	19	7.47	26
7/31/1995	23.9	7.72	24
12/8/1994	11.8	7.8	18
11/15/1994	11	7.37	20
10/19/1994	13.8	7.25	22
9/12/1994	19.8	7.76	25
8/24/1994	14	7.64	19
7/28/1994	20.1	6.89	26
12/15/1993	5.9	7.2	30
10/27/1993	14.9	7.1	34
9/20/1993	20.6	7.1	26
8/25/1993	22.7	7.2	20
7/28/1993	21.6	7.8	24
12/22/1992	7.8	6.8	23
11/16/1992	9.4	6.9	26
11/9/1992	7.5	7.6	30
10/26/1992	13.7	7.7	34
9/24/1992	17.5	7.7	28
8/25/1992	18.9	7.8	24
8/24/1992			
7/16/1992	20.4	6.8	24
12/11/1991	11.5	7.7	24
10/21/1991	13.2	7.8	24
9/16/1991			34
9/13/1991	22.7	7.7	
8/21/1991	21.3	8.4	20
7/15/1991			
12/18/1990	8.3	7.7	36
11/15/1990	11.8	8.1	24
10/30/1990	13.3	7.7	26
9/27/1990	16.3	7.8	22
8/21/1990	2.28	7.5	
7/24/1990	23.1	7.7	24
12/21/1989	5.3	7.9	20
11/16/1989	14.4	7.9	42
10/30/1989			
9/26/1989	16.4	7.7	
9/26/1989			22
8/23/1989	19.2	7.2	
8/23/1989			26
7/27/1989	16.5	7.7	26
12/8/1988			26
11/14/1988			24
10/24/1988			24
9/22/1988			24
7/18/1988			24

Bacteria TMDL Development for the Dan River, Blackberry Creek, Byrds Branch, Double Creek, Fall Creek, Leatherwood Creek, Marrowbone Creek, North Fork Mayo River, South Fork Mayo River, Smith River, Sandy Creek, and Sandy River Watersheds

Submitted by

Virginia Department of Environmental Qualit

5.14 Smith River (VAW-L54R-01) TMDL

5.14.1 Smith River Wasteload Allocation

There are 2 facilities in the Smith River watershed permitted to discharge bacteria (see Chapter 4). For this TMDL, the wasteload allocation for permitted facilities is to maintain discharge at the design flow limits and bacteria concentrations at their permitted levels of 126 cfu/100mL. **Table 5-31** shows the loading from the permitted point source dischargers in the watershed. To account for future growth, the WLA was developed using 5 times the original allocation.

Table 5-31: Smith River (VAW-L54R-01) Wasteload Allocation for *E. coli*

Point Source	Existing Load (cfu/day)	Allocated Load (cfu/day)	Allocated Load (cfu/year)	Percent Reduction
VA0025305	3.82E+10	3.82E+10	1.39E+13	0%
VA0069345	1.91E+10	1.91E+10	6.97E+12	0%
Total	**5.73E+10**	**5.73E+10**	**2.09E+13**	**0%**
Total (Future Growth)			**1.05E+14**	**-**

5.14.2 Smith River (VAW-L54R-01) Load Allocation

The scenarios considered for Smith River (Reach 36) load allocation are presented in **Table 5-32.** The following conclusions can be made:

1. In Scenario 0 (existing conditions), the water quality standard was violated more than forty percent of the time in the Smith River.
2. In Scenario 3, elimination of the human sources (failed septic systems and straight pipes) and the livestock direct instream loading resulted in a 43 percent violation of this standard in the Smith River and a 48 percent violation of the *E. coli* instantaneous standard.
3. In Scenario 4, eliminating all sources except direct instream loading from wildlife resulted in no violations of either the *E. coli* geometric mean standard or the instantaneous *E. coli* standard.
4. No violations of either the *E. coli* geometric mean standard or the instantaneous *E. coli* standard occurred in the Smith River under Scenario 11.

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L54*

Cause Group Code: **L54R-01-BAC** **Smith River**

Location: The bacteria impairment begins at the Martinsville Dam (Martinsville West Quad) and extends downstream to the VA/NC State Line on the Northwest Eden Quad.

City / County: Henry Co. Martinsville City

Use(s): Recreation

Cause(s) / VA Category: Escherichia coli/ 4A

The Dan River Bacteria Total Maximum Daily Load (TMDL) is U.S. EPA approved on 12/08/2008 [Fed ID 35757] and SWCB approved 4/28/2009. The Dan River Bacteria TMDL incorporates the Smith River as it lies within the TMDL Watershed. The TMDL and allocations can be viewed at http://www.deq.virginia.gov.

Station 4ASRE022.71 is a 1999 Federal Consent Decree Attachment B station and was not 2002 listed as impaired. Only four of 59 samples exceeded the former 1000 cfu/100 ml instantaneous criterion for an exceedance rate of 6 percent in 2002. The 2002 303(d) Listing for 10.16 miles has been extended upstream 3.59 miles (2004 Integrated Report (IR)) and downstream 6.30 miles (2006 IR) for a total of 20.05 miles thru the 2008 Assessment.

4ASRE026.27- There are no additional benthic data beyond the 2008 assessment where two E.coli samples exceed the 235 cfu/100 ml instantaneous criterion from 21 total samples. The E.coli data indicate this station would meet delisting guidance however the range of exceeding values is from 600 to 1060 cfu/100 ml. Due to the magnitude of the exceedances and the downstream exceedances the waters remain impaired for the Recreational Use.

4ASRE022.71- (Footbridge above the Martinsville STP) There are no additional data beyond the 2004 IR where eight of 41 FC samples exceed the former 400 cfu/100 ml instantaneous criterion. Exceeding values range from 500 to greater than 8000 cfu/100 ml. The 2004 IR 303(d) Listing extends the 2002 bacteria impairment 3.59 miles upstream from the original 303(d) Listing. Data within the 2006 data window find three of 17 samples in excess of the criterion with exceeding values ranging from 600 to 900 cfu/100 ml.

4ASRE021.58 (Rt. 58 Bypass Bridge, Henry Co.) There are no additional E.coli data beyond the 2008 assessment where E.coli excursions range from 300 to 1400 cfu/100 ml in four of nine samples. Each exceedance is in excess of the 235 cfu/100 ml instantaneous criterion. The 2006 data window produces three of 17 FC samples in excess of the former 400 cfu/100 ml instantaneous criterion ranging from 1100 to greater than 8000 cfu/100 ml. The 2004 IR reports six of 35 FC observations exceed the instantaneous criterion. The exceeding values range from 600 to greater than 8000 cfu/100 ml.

4ASRE019.00- Both the 2010 and 2008 assessments find six of 20 E.coli observations exceed the 235 cfu/100 ml instantaneous criterion within their respective data windows. Exceeding values range from 250 to 1060 cfu/100 ml. Two of six geometric mean calculations exceed the former (2 samples / calendar month) 126 cfu/100 ml criterion at 150 and 235. There are no additional data beyond the 2008 assessment.

4ASRE015.43 (Rt. 636 Bridge) There are no additional E.coli data beyond the 208 assessment. Both the 2010 and 2008 assessments find E.coli exceed the instantaneous criterion in four of 20 samples. The range of exceedance is from 250 to 990 cfu/100 ml in each respective data window. One of six geometric mean calculations exceeds the former (2 samples / calendar month) 126 cfu/100 ml criterion at 306 in 2008. One excursion of the instantaneous criterion is found from 17 observations within the 2006 data window. The single exceedance is 1100 cfu/100 ml. 2004 IR findings are FC exceeds the former 400 cfu/100 ml criterion in six of 35 samples. Exceeding values range from 500 to 1300 cfu/100 ml.

4ASRE007.90- Escherichia coli (E.coli) exceedances of the WQS 235 cfu/100 ml instantaneous criterion range from 250 to 1500 cfu/100 ml from seven of 36 samples within the 2012 data window. The 2010 data window finds eight of 33 E.coli samples exceed the instantaneous criterion. Values in excess of the criterion range from 250 to 1700 cfu/100 ml. 2008 E.coli exceedances of the instantaneous criterion range from 250 to 600 cfu/100 ml from six of 21 samples. The

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L54*

2006 IR found six of 48 FC samples exceed the 400 cfu/100 ml instantaneous criterion with exceedances ranging from 600 to 950 cfu/100 ml within the 2006 data window.

Assessment Unit / Water Name / Description	Cause	Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L54R_SRE01A00 / Smith River / Smith River mainstem from the Home Creek mouth downstream to VA/NC State Line.	4A	Escherichia coli	Y	2008	12/8/2008	3.22
VAW-L54R_SRE02A00 / Smith River / The mainstem Smith River located between the Turkey Pen Creek mouth downstream to the Home Creek mouth.	4A	Escherichia coli	Y	2008	12/8/2008	3.08
VAW-L54R_SRE03A00 / Smith River / Smith River mainstem from the Leatherwood Creek mouth downstream to the confluence of Turkeypen Creek.	4A	Escherichia coli		2008	12/8/2008	4.75
VAW-L54R_SRE03A02 / Smith River / Smith River mainstem from the Marrowbone Creek mouth downstream to the confluence of Leatherwood Creek.	4A	Escherichia coli		2008	12/8/2008	1.72
VAW-L54R_SRE04A00 / Smith River / The mainstem Smith River located between the HCPSA Lower Smith River STP and the confluence of Marrowbone Creek.	4A	Escherichia coli		2008	12/8/2008	0.38
VAW-L54R_SRE05A00 / Smith River / The mainstem Smith River located between the Martinsville City STP outfall downstream to the Henry County PSA Lower Smith STP outfall.	4A	Escherichia coli		2008	12/8/2008	3.31
VAW-L54R_SRE06A00 / Smith River / The mainstem Smith River located between the Martinsville Dam downstream to Martinsville City STP outfall.	4A	Escherichia coli		2008	12/8/2008	3.59

Smith River

DCR Watershed: L54*

Recreation	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Escherichia coli - Total Impaired Size by Water Type:			**20.05**

Sources:

- Livestock (Grazing or Feeding Operations)
- Municipal (Urbanized High Density Area)
- Unspecified Domestic Waste
- Wet Weather Discharges (Non-Point Source)
- Wildlife Other than Waterfowl

*Header Information: Location, City/County, Cause/VA Category and Narratives; describe the entire extent of the Impairment. Sizes presented are for Assessment Units (AUs) lying within the DCR Watershed boundary noted above.

2012 Impaired Waters

Categories 4 and 5 by DCR Watershed*

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L54*

Cause Group Code: **L54R-01-BEN** **Smith River**

Location: The benthic impairment begins near the Martinsville WWTP outfall and extends downstream to the mouth of Turkeypen Creek.

City / County: Henry Co. Martinsville City

Use(s): Aquatic Life

Cause(s) / VA Category: Benthic-Macroinvertebrate Bioassessments/ 4A

The Smith River General Standard - Benthic TMDL received U.S. EPA approval on 1/13/2011 for a phased approach. Federal IDs are 39703, 39705, 39706 and 39707. Phase I seeks to define and identify stressors to the benthic community beyond general identification. The benthic impairment for 3.59 miles (Assessment Unit VAW-L54R_SRE06A00 / Fed ID 39705) is de-listed with the 2012 assessment leaving 10.16 miles remaining impaired.

The 1998 Aquatic Life Use impairment remains for these 10.16 mile waters. Two municipal facilities have closed as a result of industrial plant closings in the Martinsville / Henry County area. Greatly reduced influent chloride levels from industrial inputs to the Martinsville STP are a result. An earlier 1998 Corbicula study indicates chlorides may have impacted the benthos. However the benthic community impairment remains.

4ASRE026.04 (below Martinsville Dam formerly coded 4ASRE026.38) This station has been abandoned for benthic collections due to safety concerns.
Bio 'IM' [EDAS coded 4ASRE026.38] There are no additional benthic data beyond the 2008 assessment where two Virginia Stream Condition Index (VSCI) surveys (2003 & 2004) score an average of 49.2. The Martinsville Dam affects the river by periodically causing the stream substrate to become dewatered, reducing the amount of habitat available for benthic macro invertebrate production. The Dam also affects water quality from releases of water higher in temperature and lower in oxygen than it would be without the impoundment. Improvements by the closing of the former Upper Smith River Wastewater Treatment Plant may be responsible for increased assessment scores since 2000. However, improvements in the community may be negated by the Martinsville Dam effect.

4ASRE022.30 (below the Martinsville STP) Bio 'IM' 2012 benthic collections find impairment from nine VSCI surveys (2005 thru 2010) with an average six year score of 53.52 and 2 year score of 56.47. Bio 'IM' Seven VSCI surveys (2003 thru 2008 - 2010 data window) score an average of 52.0 and 2001 thru 2006 - 2008 data window) of 51.3.

The historical data show a slight improvement in VSCI scores. Historical data also show that the benthic community at this site typically consisted of more pollution tolerant taxa in the spring. This station and 4ASRE033.19 show the least improvement of the stations sampled for the Smith River TMDL. The 2008 samples show an improvement in the community from the sample collected in 2007. The fall 2005 survey indicated a community dominated by the moderately tolerant caddisfly Hydropsychidae (an indication of organic and nutrient pollution). Improvement in the operation of the Martinsville WWTP may be responsible for the increasing assessment scores since 2001.

4ASRE019.00 (above the Marrowbone Creek mouth) Bio 'IM' Nine VSCI surveys (2005-2010; 2012 data window) with an average six year score of 49.58 and two year score of 49.71. Seven VSCI surveys score an average (2003 thru 2008 - 2010 data window) of 46.8 and (2001 thru 2006 five surveys 2008 data window) score 42.4.

The dominant family observed has typically been the moderately tolerant caddisfly Hydropsychidae (an indication of organic and nutrient pollution). In the most recent surveys, Hydropsychidae and Simuliidae dominated the samples. The numbers of these individuals per sample appears to be declining. The Fall 2009 non-impaired sample had the largest percentage (27.84%) of mayflies during the assessment period (VSCI=62.08). The second highest VSCI score (58.22) had 13.22% mayflies. In the fall 2001 survey, the numbers of sensitive insects in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) decreased and the number of pollution tolerant organisms increased relative to earlier surveys. The 2010 data window found from the two most recent surveys (2007-

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L54*

2008), Hydropsychidae and other nutrient/organic pollution tolerant families dominated the samples. This station is downstream of the Martinsville and former Lower Smith River (Henry County PSA) WWTPs. Non-point source urban runoff and sediment from land use conversion throughout the watershed also affect the river. The closure of the Lower Smith River Wastewater Treatment Plant (just upstream of this station) in November 2005 did not appear to have a significant affect on the benthic community.

4ASRE015.43 (Rt. 636 Bridge) Bio 'IM' Benthic collections within the 2012 data window report Nine VSCI surveys (2005-2010) with an average six year score of 54.9 and two year score (2009-2010) of 55.57.

Seven VSCI surveys (2003 thru 2008 are within the 2010 data window) score an average of 57.4 and (2001 thru 2006 five surveys 2008 data window) score 52.1.

This station is the furthest downstream biological monitoring site and the first site where the benthic community historically showed signs of recovery. This site has shown improvement in the Fall scores since Fall 2006, but a decline in the Fall 2010 sample. Non-point source urban runoff and sediment appear to affect the river. The station is located downstream of Leatherwood Creek which may be a significant source of sediment. Recent surveys show that the benthic community is dominated by the moderately tolerant caddisfly Hydropsychidae as well as Chironomidae and Simulidae, an indication of organic and nutrient pollution. There was some improvement in the benthic community between Fall 2006 and 2009. The same affect was found with improvement in the benthic community scores between 1999 and 2001 as well (2008 data window). Improved water quality may have been the result of operational improvements at the Martinsville WWTP. However, the decline in benthic community scores in spring 2008-2010 and Fall 2008 and 2010 indicates that water quality at this site is still degraded.

Assessment Unit / Water Name / Description	Cause	Category / Name	Nested	Cycle First Listed	TMDL Schedule or EPA Approval	Size
VAW-L54R_SRE03A00 / Smith River / Smith River mainstem from the Leatherwood Creek mouth downstream to the confluence of Turkeypen Creek.	4A	Benthic-Macroinvertebrate Bioassessments		1998	1/13/2011	4.75
VAW-L54R_SRE03A02 / Smith River / Smith River mainstem from the Marrowbone Creek mouth downstream to the confluence of Leatherwood Creek.	4A	Benthic-Macroinvertebrate Bioassessments		1998	1/13/2011	1.72
VAW-L54R_SRE04A00 / Smith River / The mainstem Smith River located between the HCPSA Lower Smith River STP and the confluence of Marrowbone Creek.	4A	Benthic-Macroinvertebrate Bioassessments		1998	1/13/2011	0.38
VAW-L54R_SRE05A00 / Smith River / The mainstem Smith River located between the Martinsville City STP outfall downstream to the Henry County PSA Lower Smith STP outfall.	4A	Benthic-Macroinvertebrate Bioassessments		1998	1/13/2011	3.31

Smith River

DCR Watershed: L54*

	Estuary (Sq. Miles)	Reservoir (Acres)	River (Miles)
Aquatic Life			
Benthic-Macroinvertebrate Bioassessments - Total Impaired Size by Water Type:			**10.16**

Roanoke and Yadkin River Basins

Fact Sheet prepared for DCR Watershed: L54*

Sources:

Dam or Impoundment	Municipal (Urbanized High Density Area)	Sediment Resuspension (Clean Sediment)	Silviculture Harvesting

*Header Information: Location, City/County, Cause/VA Category and Narratives; describe the entire extent of the Impairment. Sizes presented are for Assessment Units (AUs) lying within the DCR Watershed boundary noted above.

Attachment F

Wasteload and Limit Calculations

- Mixing Zone Calculations (MIXER)
- Daily Effluent pH Data
- BOD5 DMR Data
- Wasteload Allocation Spreadsheet
- STATS Program Results

Mixing Zone Predictions for Martinsville STP

Effluent Flow = 8.0 MGD
Stream 7Q10 = 90 MGD
Stream 30Q10 = 107 MGD
Stream 1Q10 = 25 MGD
Stream slope = 0.00208 ft/ft
Stream width = 100 ft
Bottom scale = 3
Channel scale = 1

Mixing Zone Predictions @ 7Q10

Depth = 1.7379 ft
Length = 5888.85 ft
Velocity = .8729 ft/sec
Residence Time = .0781 days

Recommendation:

A complete mix assumption is appropriate for this situation and the entire 7Q10 may be used.

Mixing Zone Predictions @ 30Q10

Depth = 1.9156 ft
Length = 5417.39 ft
Velocity = .9293 ft/sec
Residence Time = .0675 days

Recommendation:

A complete mix assumption is appropriate for this situation and the entire 30Q10 may be used.

Mixing Zone Predictions @ 1Q10

Depth = .8986 ft
Length = 10314.95 ft
Velocity = .5685 ft/sec
Residence Time = 5.0402 hours

Recommendation:

A complete mix assumption is appropriate for this situation providing no more than 19.84% of the 1Q10 is used.

Virginia DEQ Mixing Zone Analysis Version 2.1

Martinsville Water Pollution Control Plant
VA0025305, Daily Effluent pH Data

Day	N	D	J	F	M	A	M	J	J	A	S	O
1	6.8	6.7	6.7	6.7	6.8	6.6	6.7	6.8	6.8	6.8	7.0	6.6
2	6.9	6.8	6.8	6.5	6.7	6.5	6.7	6.7	6.9	6.8	6.7	6.5
3	6.8	6.8	6.7	6.7	6.7	6.5	6.7	6.7	6.9	6.8	6.6	6.6
4	6.9	6.8	6.9	6.7	6.7	6.6	7.0	6.8	6.9	6.8	6.8	6.7
5	6.9	6.8	6.9	6.5	6.7	6.6	6.9	6.8	7.0	6.6	7.0	6.6
6	6.9	6.8	6.8	6.7	6.7	6.6	6.8	6.8	6.8	6.8	7.1	6.7
7	7.0	6.8	6.8	6.6	6.7	6.6	6.8	6.8	6.9	6.7	7.1	6.6
8	7.0	6.8	7.0	6.5	6.6	6.6	6.8	6.8	6.8	6.9	7.0	6.7
9	6.9	6.8	6.9	6.6	6.7	6.6	7.0	6.6	6.8	6.9	7.1	6.7
10	6.8	6.9	6.9	6.8	6.7	6.7	6.6	6.7	6.8	6.9	7.0	6.7
11	6.9	6.8	6.9	6.8	6.6	6.7	6.7	6.6	6.7	6.9	6.8	6.8
12	6.9	6.8	6.9	6.9	6.6	6.7	6.8	6.6	6.4	6.8	7.0	6.7
13	7.0	6.7	6.8	6.8	6.6	6.7	6.7	6.7	6.7	6.8	6.9	6.7
14	7.0	6.6	6.8	6.6	6.7	6.6	6.8	6.6	6.7	6.8	7.3	6.6
15	7.0	6.8	6.9	6.7	6.7	6.5	6.8	6.6	6.6	6.8	7.2	6.7
16	6.9	6.8	6.9	6.7	6.7	6.7	6.9	6.6	6.7	6.9	7.1	6.5
17	6.9	6.7	6.8	6.7	6.7	6.7	6.9	6.6	6.8	6.9	7.2	6.7
18	6.9	6.8	6.6	6.7	6.5	6.6	6.9	6.7	6.8	6.8	7.2	6.6
19	7.0	6.7	6.6	6.7	6.6	6.7	6.9	6.6	6.9	6.7	7.3	6.6
20	7.0	6.7	6.6	6.7	6.7	6.8	6.9	6.6	6.9	6.7	7.3	6.5
21	6.7	6.8	6.6	6.7	6.7	6.6	6.9	6.7	6.8	6.7	7.3	6.4
22	6.7	6.8	6.6	6.5	6.7	6.6	6.9	6.6	6.8	6.7	7.1	6.4
23	6.6	6.8	6.5	6.7	6.7	6.5	6.8	6.6	6.9	7.4	7.1	6.5
24	6.8	6.8	6.7	6.7	6.6	6.6	6.9	6.5	6.8	6.9	7.0	6.8
25	6.7	6.7	6.7	6.5	6.6	6.6	6.9	6.5	6.8	6.8	7.0	6.9
26	6.8	6.6	6.7	6.6	6.5	6.7	6.8	6.5	6.8	6.8	6.9	6.7
27	6.6	6.8	6.8	6.6	6.7	6.7	6.8	6.5	6.8	6.6	7.1	6.6
28	6.7	6.7	6.6	6.7	6.8	6.7	6.7	6.6	6.8	6.6	6.9	6.6
29	6.7	6.7	6.5	6.7	7.0	6.7	6.7	6.5	6.8	6.7	6.8	6.6
30	6.8	6.7	6.7	6.0	6.8	6.7	6.8	6.8	6.7	6.9	6.7	6.6
31	6.0	6.7	6.6	6.0	6.5	6.0	6.8		6.7	7.0		6.6

6.90 = 90th percentile pH, S.U.
6.60

FRESHWATER
WATER QUALITY CRITERIA / WASTELOAD ALLOCATION ANALYSIS

Facility Name: Martinsville STP Permit No.: VA0025305

Receiving Stream: Smith River Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information

Mean Hardness (as CaCO3) =	100	mg/L
90% Temperature (Annual) =	21.6	deg C
90% Temperature (Wet season) =	20.2	deg C
90% Maximum pH =	8.1	SU
10% Maximum pH =	6.9	SU
Tier Designation (1 or 2) =	1	
Public Water Supply (PWS) Y/N? =	n	
Trout Present Y/N? =	n	
Early Life Stages Present Y/N? =	y	

Stream Flows

1Q10 (Annual) =	25	MGD
7Q10 (Annual) =	90	MGD
30Q10 (Annual) =	107	MGD
1Q10 (Wet season) =	38	MGD
30Q10 (Wet season)	124	MGD
30Q5 =	122	MGD
Harmonic Mean =	194	MGD

Mixing Information

Annual - 1Q10 Mix =	19.84	%
- 7Q10 Mix =	100	%
- 30Q10 Mix =	100	%
Wet Season - 1Q10 Mix =	100	%
- 30Q10 Mix =	100	%

Effluent Information

Mean Hardness (as CaCO3) =	108	mg/L
90% Temp (Annual) =	29	deg C
90% Temp (Wet season) =	19	deg C
90% Maximum pH =	6.9	SU
10% Maximum pH =	6.6	SU
Discharge Flow =	8	MGD

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Acenapthene	5	--	--	na	9.9E+02	--	--	na	1.6E+04	--	--	--	--	--	--	--	--	--	--	na	1.6E+04
Acrolein	0	--	--	na	9.3E+00	--	--	na	1.5E+02	--	--	--	--	--	--	--	--	--	--	na	1.5E+02
Acrylonitrile [C]	0	--	--	na	2.5E+00	--	--	na	6.3E+01	--	--	--	--	--	--	--	--	--	--	na	6.3E+01
Aldrin [C]	0	3.0E+00	--	na	5.0E-04	4.9E+00	--	na	1.3E-02	--	--	--	--	--	--	--	--	4.9E+00	--	na	1.3E-02
Ammonia-N (mg/l) (Yearly)	0	3.31E+01	1.97E+00	na	--	5.36E+01	2.83E+01	na	--	--	--	--	--	--	--	--	--	5.36E+01	2.83E+01	na	--
Ammonia-N (mg/l) (High Flow)	0	1.85E+01	2.16E+00	na	--	1.07E+02	3.56E+01	na	--	--	--	--	--	--	--	--	--	1.07E+02	3.56E+01	na	--
Anthracene	0	--	--	na	4.0E+04	--	--	na	6.5E+05	--	--	--	--	--	--	--	--	--	--	na	6.5E+05
Antimony	0	--	--	na	6.4E+02	--	--	na	1.0E+04	--	--	--	--	--	--	--	--	--	--	na	1.0E+04
Arsenic	o	3.4E+02	1.5E+02	na	--	5.5E+02	1.8E+03	na	--	--	--	--	--	--	--	--	--	5.5E+02	1.8E+03	na	--
Barium	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Benzene [C]	0	--	--	na	5.1E+02	--	--	na	1.3E+04	--	--	--	--	--	--	--	--	--	--	na	1.3E+04
Benzidine [C]	0	--	--	na	2.0E-03	--	--	na	5.1E-02	--	--	--	--	--	--	--	--	--	--	na	5.1E-02
Benzo (a) anthracene [C]	0	--	--	na	1.8E-01	--	--	na	4.5E+00	--	--	--	--	--	--	--	--	--	--	na	4.5E+00
Benzo (b) fluoranthene [C]	0	--	--	na	1.8E-01	--	--	na	4.5E+00	--	--	--	--	--	--	--	--	--	--	na	4.5E+00
Benzo (k) fluoranthene [C]	0	--	--	na	1.8E-01	--	--	na	4.5E+00	--	--	--	--	--	--	--	--	--	--	na	4.5E+00
Benzo (a) pyrene [C]	0	--	--	na	1.8E-01	--	--	na	4.5E+00	--	--	--	--	--	--	--	--	--	--	na	4.5E+00
Bis2-Chloroethyl Ether [C]	0	--	--	na	5.3E+00	--	--	na	1.3E+02	--	--	--	--	--	--	--	--	--	--	na	1.3E+02
Bis2-Chloroisopropyl Ether	0	--	--	na	6.5E+04	--	--	na	1.1E+06	--	--	--	--	--	--	--	--	--	--	na	1.1E+06
Bis 2-Ethylhexyl Phthalate [C]	0	--	--	na	2.2E+01	--	--	na	5.6E+02	--	--	--	--	--	--	--	--	--	--	na	5.6E+02
Bromoform [C]	0	--	--	na	1.4E+03	--	--	na	3.5E+04	--	--	--	--	--	--	--	--	--	--	na	3.5E+04
Butylbenzylphthalate	0	--	--	na	1.9E+03	--	--	na	3.1E+04	--	--	--	--	--	--	--	--	--	--	na	3.1E+04
Cadmium	0	4.1E+00	1.1E+00	na	--	6.7E+00	1.4E+01	na	--	--	--	--	--	--	--	--	--	6.7E+00	1.4E+01	na	--
Carbon Tetrachloride [C]	0	--	--	na	1.6E+01	--	--	na	4.0E+02	--	--	--	--	--	--	--	--	--	--	na	4.0E+02
Chlordane [C]	0	2.4E+00	4.3E-03	na	8.1E-03	3.9E+00	5.3E-02	na	2.0E-01	--	--	--	--	--	--	--	--	3.9E+00	5.3E-02	na	2.0E-01
Chloride	0	8.6E+05	2.3E+05	na	--	1.4E+06	2.8E+06	na	--	--	--	--	--	--	--	--	--	1.4E+06	2.8E+06	na	--
TRC	0	1.9E+01	1.1E+01	na	--	3.1E+01	1.3E+02	na	--	--	--	--	--	--	--	--	--	3.1E+01	1.3E+02	na	--
Chlorobenzene	0	--	--	na	1.6E+03	--	--	na	2.6E+04	--	--	--	--	--	--	--	--	--	--	na	2.6E+04

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				Most Limiting Allocations			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH
Chlorodibromomethane[C]	0	--	--	na	1.3E+02	--	--	na	3.3E+03	--	--	--	--	--	--	--	--	--	--	na	3.3E+03
Chloroform	0	--	--	na	1.1E+04	--	--	na	1.8E+05	--	--	--	--	--	--	--	--	--	--	na	1.8E+05
2-Chloronaphthalene	0	--	--	na	1.6E+03	--	--	na	2.6E+04	--	--	--	--	--	--	--	--	--	--	na	2.6E+04
2-Chlorophenol	0	--	--	na	1.5E+02	--	--	na	2.4E+03	--	--	--	--	--	--	--	--	--	--	na	2.4E+03
Chlorpyrifos	0	8.3E-02	4.1E-02	na	--	1.3E-01	5.0E-01	na	--	--	--	--	--	--	--	--	--	1.3E-01	5.0E-01	na	--
Chromium III	0	5.9E+02	7.5E+01	na	--	9.6E+02	9.1E+02	na	--	--	--	--	--	--	--	--	--	9.6E+02	9.1E+02	na	--
Chromium VI	0	1.6E+01	1.1E+01	na	--	2.6E+01	1.3E+02	na	--	--	--	--	--	--	--	--	--	2.6E+01	1.3E+02	na	--
Chromium, Total	0	--	--	1.0E+02	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
Chrysene [C]	0	--	--	na	1.8E-02	--	--	na	4.5E-01	--	--	--	--	--	--	--	--	--	--	na	4.5E-01
Copper	0	1.4E+01	9.0E+00	na	--	2.3E+01	1.1E+02	na	--	--	--	--	--	--	--	--	--	2.3E+01	1.1E+02	na	--
Cyanide, Free	0	2.2E+01	5.2E+00	na	1.6E+04	3.6E+01	6.4E+01	na	2.6E+05	--	--	--	--	--	--	--	--	3.6E+01	6.4E+01	na	2.6E+05
DDD [C]	0	--	--	na	3.1E-03	--	--	na	7.8E-02	--	--	--	--	--	--	--	--	--	--	na	7.8E-02
DDE [C]	0	--	--	na	2.2E-03	--	--	na	5.6E-02	--	--	--	--	--	--	--	--	--	--	na	5.6E-02
DDT [C]	0	1.1E+00	1.0E-03	na	2.2E-03	1.8E+00	1.2E-02	na	5.6E-02	--	--	--	--	--	--	--	--	1.8E+00	1.2E-02	na	5.6E-02
Demeton	0	--	1.0E-01	na	--	--	1.2E+00	na	--	--	--	--	--	--	--	--	--	--	1.2E+00	na	--
Diazinon	0	1.7E-01	1.7E-01	na	--	2.8E-01	2.1E+00	na	--	--	--	--	--	--	--	--	--	2.8E-01	2.1E+00	na	--
Dibenz(a,h)anthracene [C]	0	--	--	na	1.8E-01	--	--	na	4.5E+00	--	--	--	--	--	--	--	--	--	--	na	4.5E+00
1,2-Dichlorobenzene	0	--	--	na	1.3E+03	--	--	na	2.1E+04	--	--	--	--	--	--	--	--	--	--	na	2.1E+04
1,3-Dichlorobenzene	0	--	--	na	9.6E+02	--	--	na	1.6E+04	--	--	--	--	--	--	--	--	--	--	na	1.6E+04
1,4-Dichlorobenzene	0	--	--	na	1.9E+02	--	--	na	3.1E+03	--	--	--	--	--	--	--	--	--	--	na	3.1E+03
3,3-Dichlorobenzidine[C]	0	--	--	na	2.8E-01	--	--	na	7.1E+00	--	--	--	--	--	--	--	--	--	--	na	7.1E+00
Dichlorobromomethane [C]	0	--	--	na	1.7E+02	--	--	na	4.3E+03	--	--	--	--	--	--	--	--	--	--	na	4.3E+03
1,2-Dichloroethane [C]	0	--	--	na	3.7E+02	--	--	na	9.3E+03	--	--	--	--	--	--	--	--	--	--	na	9.3E+03
1,1-Dichloroethylene	0	--	--	na	7.1E+03	--	--	na	1.2E+05	--	--	--	--	--	--	--	--	--	--	na	1.2E+05
1,2-trans-dichloroethylene	0	--	--	na	1.0E+04	--	--	na	1.6E+05	--	--	--	--	--	--	--	--	--	--	na	1.6E+05
2,4-Dichlorophenol	0	--	--	na	2.9E+02	--	--	na	4.7E+03	--	--	--	--	--	--	--	--	--	--	na	4.7E+03
2,4-Dichlorophenoxy acetic acid (2,4-D)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	na	--
1,2-Dichloropropane[C]	0	--	--	na	1.5E+02	--	--	na	3.8E+03	--	--	--	--	--	--	--	--	--	--	na	3.8E+03
1,3-Dichloropropene [C]	0	--	--	na	2.1E+02	--	--	na	5.3E+03	--	--	--	--	--	--	--	--	--	--	na	5.3E+03
Dieldrin [C]	0	2.4E-01	5.6E-02	na	5.4E-04	3.9E-01	6.9E-01	na	1.4E-02	--	--	--	--	--	--	--	--	3.9E-01	6.9E-01	na	1.4E-02
Diethyl Phthalate	0	--	--	na	4.4E+04	--	--	na	7.2E+05	--	--	--	--	--	--	--	--	--	--	na	7.2E+05
2,4-Dimethylphenol	0	--	--	na	8.5E+02	--	--	na	1.4E+04	--	--	--	--	--	--	--	--	--	--	na	1.4E+04
Dimethyl Phthalate	0	--	--	na	1.1E+06	--	--	na	1.8E+07	--	--	--	--	--	--	--	--	--	--	na	1.8E+07
Di-n-Butyl Phthalate	0	--	--	na	4.5E+03	--	--	na	7.3E+04	--	--	--	--	--	--	--	--	--	--	na	7.3E+04
2,4 Dinitrophenol	0	--	--	na	5.3E+03	--	--	na	8.6E+04	--	--	--	--	--	--	--	--	--	--	na	8.6E+04
2-Methyl-4,6-Dinitrophenol	0	--	--	na	2.8E+02	--	--	na	4.6E+03	--	--	--	--	--	--	--	--	--	--	na	4.6E+03
2,4-Dinitrotoluene [C]	0	--	--	na	3.4E+01	--	--	na	8.6E+02	--	--	--	--	--	--	--	--	--	--	na	8.6E+02
Dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin	0	--	--	na	5.1E-08	--	--	na	8.3E-07	--	--	--	--	--	--	--	--	--	--	na	8.3E-07
1,2-Diphenylhydrazine[C]	0	--	--	na	2.0E+00	--	--	na	5.1E+01	--	--	--	--	--	--	--	--	--	--	na	5.1E+01
Alpha-Endosulfan	0	2.2E-01	5.6E-02	na	8.9E+01	3.6E-01	6.9E-01	na	1.4E+03	--	--	--	--	--	--	--	--	3.6E-01	6.9E-01	na	1.4E+03
Beta-Endosulfan	0	2.2E-01	5.6E-02	na	8.9E+01	3.6E-01	6.9E-01	na	1.4E+03	--	--	--	--	--	--	--	--	3.6E-01	6.9E-01	na	1.4E+03
Alpha + Beta Endosulfan	0	2.2E-01	5.6E-02	--	--	3.6E-01	6.9E-01	--	--	--	--	--	--	--	--	--	--	3.6E-01	6.9E-01	--	--
Endosulfan Sulfate	0	--	--	na	8.9E+01	--	--	na	1.4E+03	--	--	--	--	--	--	--	--	--	--	na	1.4E+03
Endrin	0	8.6E-02	3.6E-02	na	6.0E-02	1.4E-01	4.4E-01	na	9.8E-01	--	--	--	--	--	--	--	--	1.4E-01	4.4E-01	na	9.8E-01
Endrin Aldehyde	0	--	--	na	3.0E-01	--	--	na	4.9E+00	--	--	--	--	--	--	--	--	--	--	na	4.9E+00

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Ethylbenzene	0	--	--	na	2.1E+03	--	--	na	3.4E+04	--	--	--	--	--	--	--	--	--	--	**na**	**3.4E+04**
Fluoranthene	0	--	--	na	1.4E+02	--	--	na	2.3E+03	--	--	--	--	--	--	--	--	--	--	**na**	**2.3E+03**
Fluorene	0	--	--	na	5.3E+03	--	--	na	8.6E+04	--	--	--	--	--	--	--	--	--	--	**na**	**8.6E+04**
Foaming Agents	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	**na**	**--**
Guthion	0	--	1.0E-02	na	--	--	1.2E-01	na	--	--	--	--	--	--	--	--	--	--	**1.2E-01**	**na**	**--**
Heptachlor [c]	0	5.2E-01	3.8E-03	na	7.9E-04	8.4E-01	4.7E-02	na	2.0E-02	--	--	--	--	--	--	--	--	**8.4E-01**	**4.7E-02**	**na**	**2.0E-02**
Heptachlor Epoxide[c]	0	5.2E-01	3.8E-03	na	3.9E-04	8.4E-01	4.7E-02	na	9.8E-03	--	--	--	--	--	--	--	--	**8.4E-01**	**4.7E-02**	**na**	**9.8E-03**
Hexachlorobenzene[c]	0	--	--	na	2.9E-03	--	--	na	7.3E-02	--	--	--	--	--	--	--	--	--	--	**na**	**7.3E-02**
Hexachlorobutadiene[c]	0	--	--	na	1.8E+02	--	--	na	4.5E+03	--	--	--	--	--	--	--	--	--	--	**na**	**4.5E+03**
Hexachlorocyclohexane Alpha-BHC[c]	0	--	--	na	4.9E-02	--	--	na	1.2E+00	--	--	--	--	--	--	--	--	--	--	**na**	**1.2E+00**
Hexachlorocyclohexane Beta-BHC[c]	0	--	--	na	1.7E-01	--	--	na	4.3E+00	--	--	--	--	--	--	--	--	--	--	**na**	**4.3E+00**
Hexachlorocyclohexane Gamma-BHC[c] (Lindane)	0	9.5E-01	na	na	1.8E+00	1.5E+00	--	na	4.5E+01	--	--	--	--	--	--	--	--	**1.5E+00**	--	**na**	**4.5E+01**
Hexachlorocyclopentadiene	0	--	--	na	1.1E+03	--	--	na	1.8E+04	--	--	--	--	--	--	--	--	--	--	**na**	**1.8E+04**
Hexachloroethane[c]	0	--	--	na	3.3E+01	--	--	na	8.3E+02	--	--	--	--	--	--	--	--	--	--	**na**	**8.3E+02**
Hydrogen Sulfide	0	--	2.0E+00	na	--	--	2.5E+01	na	--	--	--	--	--	--	--	--	--	--	**2.5E+01**	**na**	**--**
Indeno (1,2,3-cd) pyrene [c]	0	--	--	na	1.8E-01	--	--	na	4.5E+00	--	--	--	--	--	--	--	--	--	--	**na**	**4.5E+00**
Iron	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	**na**	**--**
Isophorone[c]	0	--	--	na	9.6E+03	--	--	na	2.4E+05	--	--	--	--	--	--	--	--	--	--	**na**	**2.4E+05**
Kepone	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	--	**0.0E+00**	**na**	**--**
Lead	0	1.3E+02	1.4E+01	na	--	2.0E+02	1.7E+02	na	--	--	--	--	--	--	--	--	--	**2.0E+02**	**1.7E+02**	**na**	**--**
Malathion	0	--	1.0E-01	na	--	--	1.2E+00	na	--	--	--	--	--	--	--	--	--	--	**1.2E+00**	**na**	**--**
Manganese	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	**na**	**--**
Mercury	0	1.4E+00	7.7E-01	- -	- -	2.3E+00	9.4E+00	- -	- -	--	--	--	--	--	--	--	--	**2.3E+00**	**9.4E+00**	**- -**	**- -**
Methyl Bromide	0	--	--	na	1.5E+03	--	--	na	2.4E+04	--	--	--	--	--	--	--	--	--	--	**na**	**2.4E+04**
Methylene Chloride [c]	0	--	--	na	5.9E+03	--	--	na	1.5E+05	--	--	--	--	--	--	--	--	--	--	**na**	**1.5E+05**
Methoxychlor	0	--	3.0E-02	na	--	--	3.7E-01	na	--	--	--	--	--	--	--	--	--	--	**3.7E-01**	**na**	**--**
Mirex	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	--	**0.0E+00**	**na**	**--**
Nickel	0	1.9E+02	2.0E+01	na	4.6E+03	3.1E+02	2.5E+02	na	7.5E+04	--	--	--	--	--	--	--	--	**3.1E+02**	**2.5E+02**	**na**	**7.5E+04**
Nitrate (as N)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	**na**	**--**
Nitrobenzene	0	--	--	na	6.9E+02	--	--	na	1.1E+04	--	--	--	--	--	--	--	--	--	--	**na**	**1.1E+04**
N-Nitrosodimethylamine[c]	0	--	--	na	3.0E+01	--	--	na	7.6E+02	--	--	--	--	--	--	--	--	--	--	**na**	**7.6E+02**
N-Nitrosodiphenylamine[c]	0	--	--	na	6.0E+01	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	--	--	**na**	**1.5E+03**
N-Nitrosodi-n-propylamine[c]	0	--	--	na	5.1E+00	--	--	na	1.3E+02	--	--	--	--	--	--	--	--	--	--	**na**	**1.3E+02**
Nonylphenol	0	2.8E+01	6.6E+00	--	--	4.5E+01	8.1E+01	na	--	--	--	--	--	--	--	--	--	**4.5E+01**	**8.1E+01**	**na**	**--**
Parathion	0	6.5E-02	1.3E-02	na	--	1.1E-01	1.6E-01	na	--	--	--	--	--	--	--	--	--	**1.1E-01**	**1.6E-01**	**na**	**--**
PCB Total[c]	0	--	1.4E-02	na	6.4E-04	--	1.7E-01	na	1.6E-02	--	--	--	--	--	--	--	--	--	**1.7E-01**	**na**	**1.6E-02**
Pentachlorophenol [c]	0	6.4E+00	5.8E+00	na	3.0E+01	1.0E+01	7.2E+01	na	7.6E+02	--	--	--	--	--	--	--	--	**1.0E+01**	**7.2E+01**	**na**	**7.6E+02**
Phenol	0	--	--	na	8.6E+05	--	--	na	1.4E+07	--	--	--	--	--	--	--	--	--	--	**na**	**1.4E+07**
Pyrene	0	--	--	na	4.0E+03	--	--	na	6.5E+04	--	--	--	--	--	--	--	--	--	--	**na**	**6.5E+04**
Radionuclides	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	**na**	**--**
Gross Alpha Activity (pCi/L)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	**na**	**--**
Beta and Photon Activity (mrem/yr)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	**na**	**--**
Radium 226 + 228 (pCi/L)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	**na**	**--**
Uranium (ug/l)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	--	--	**na**	**--**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Selenium, Total Recoverable	0	2.0E+01	5.0E+00	na	4.2E+03	3.2E+01	6.1E+01	na	6.8E+04	--	--	--	--	--	--	--	--	**3.2E+01**	**6.1E+01**	**na**	**6.8E+04**
Silver	0	3.7E+00	--	na	--	6.1E+00	--	na	--	--	--	--	--	--	--	--	--	**6.1E+00**	**--**	**na**	**--**
Sulfate	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
1,1,2,2-Tetrachloroethane[C]	0	--	--	na	4.0E+01	--	--	na	1.0E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.0E+03**
Tetrachloroethylene[C]	0	--	--	na	3.3E+01	--	--	na	8.3E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.3E+02**
Thallium	0	--	--	na	4.7E-01	--	--	na	7.6E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.6E+00**
Toluene	0	--	--	na	6.0E+03	--	--	na	9.8E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.8E+04**
Total dissolved solids	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Toxaphene [C]	0	7.3E-01	2.0E-04	na	2.8E-03	1.2E+00	2.5E-03	na	7.1E-02	--	--	--	--	--	--	--	--	**1.2E+00**	**2.5E-03**	**na**	**7.1E-02**
Tributyltin	0	4.6E-01	7.2E-02	na	--	7.5E-01	8.8E-01	na	--	--	--	--	--	--	--	--	--	**7.5E-01**	**8.8E-01**	**na**	**--**
1,2,4-Trichlorobenzene	0	--	--	na	7.0E+01	--	--	na	1.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+03**
1,1,2-Trichloroethane[C]	0	--	--	na	1.6E+02	--	--	na	4.0E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.0E+03**
Trichloroethylene [C]	0	--	--	na	3.0E+02	--	--	na	7.6E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.6E+03**
2,4,6-Trichlorophenol [C]	0	--	--	na	2.4E+01	--	--	na	6.1E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.1E+02**
2-(2,4,5-Trichlorophenoxy) propionic acid (Silvex)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Vinyl Chloride[C]	0	--	--	na	2.4E+01	--	--	na	6.1E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.1E+02**
Zinc	0	1.2E+02	1.2E+02	na	2.6E+04	2.0E+02	1.5E+03	na	4.2E+05	--	--	--	--	--	--	--	--	**2.0E+02**	**1.5E+03**	**na**	**4.2E+05**

Notes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise
2. Discharge flow is highest monthly average or Form 2C maximum for Industries and design flow for Municipals
3. Metals measured as Dissolved, unless specified otherwise
4. "C" indicates a carcinogenic parameter
5. Regular WLAs are mass balances (minus background concentration) using the % of stream flow entered above under Mixing Information.
   Antidegradation WLAs are based upon a complete mix.
6. Antideg. Baseline = (0.25(WQC - background conc.) + background conc.) for acute and chronic
   = (0.1(WQC - background conc.) + background conc.) for human health
7. WLAs established at the following stream flows: 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens and Harmonic Mean for Carcinogens. To apply mixing ratios from a model set the stream flow equal to (mixing ratio - 1), effluent flow equal to 1 and 100% mix.

Metal	Target Value (SSTV)
Antimony	1.0E+04
Arsenic	2.2E+02
Barium	na
Cadmium	2.7E+00
Chromium III	3.8E+02
Chromium VI	1.0E+01
Copper	9.1E+00
Iron	na
Lead	8.2E+01
Manganese	na
Mercury	9.1E-01
Nickel	1.2E+02
Selenium	1.3E+01
Silver	2.4E+00
Zinc	7.9E+01

Note: do not use QL's lower than the minimum QL's provided in agency guidance

1/10/2014 11:14:24 AM

Facility = Martinsville STP
Chemical = Ammonia
Chronic averaging period = 30
WLAa = 54
WLAc = 28
Q.L. = 0.2
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:

9

1/10/2014 11:50:44 AM

Facility = Martinsville STP
Chemical = TRC
Chronic averaging period = 4
WLAa = 31
WLAc = 130
Q.L. = 100
# samples/mo. = 360
# samples/wk. = 90

Summary of Statistics:

observations = 1
Expected Value = 4000
Variance = 5760000
C.V. = 0.6
97th percentile daily values = 9733.67
97th percentile 4 day average = 6655.16
97th percentile 30 day average= 4824.21
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Acute Toxicity
Maximum Daily Limit = 31
Average Weekly limit = 14.3183325572961
Average Monthly LImit = 13.4970490608729

The data are:

4000

1/10/2014 11:45:24 AM

Facility = Martinsville STP
Chemical = zinc
Chronic averaging period = 4
WLAa = 200
WLAc = 1500
Q.L. = 10
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 3
Expected Value = 9.27748
Variance = 30.9858
C.V. = 0.6
97th percentile daily values = 22.5760
97th percentile 4 day average = 15.4357
97th percentile 30 day average= 11.1891
< Q.L. = 2
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

30
0
0

1/10/2014 11:46:23 AM

Facility = Martinsville STP
Chemical = cyanide
Chronic averaging period = 4
WLAa = 36
WLAc = 64
Q.L. = 3
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:

observations = 2
Expected Value = 3.49857
Variance = 4.4064
C.V. = 0.6
97th percentile daily values = 8.51348
97th percentile 4 day average = 5.82088
97th percentile 30 day average= 4.21946
< Q.L. = 1
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:

6
0

"Model Run For C:\Users\pvu61777\Documents\000_kaharlow\Martinsville_STP - VA0025305\VA0025305_14\Technical\VA0025305_Regional Model.mod On 1/10/2014 2:04:51 PM"

"Model is for SMITH RIVER."
"Model starts at the MARTINSVILLE STP discharge."

"Background Data"

"7Q10"	"cBOD5"	"TKN"	"DO"	"Temp"
"(mgd)"	"(mg/l)"	"(mg/l)"	"(mg/l)"	"deg C"
90,	2,	0,	7.711,	22

"Discharge/Tributary Input Data for Segment 1"

"Flow"	"cBOD5"	"TKN"	"DO"	"Temp"
"(mgd)"	"(mg/l)"	"(mg/l)"	"(mg/l)"	"deg C"
8,	22.5,	9,	,6,	22

"Hydraulic Information for Segment 1"

"Length"	"Width"	"Depth"	"Velocity"
"(mi)"	"(ft)"	"(ft)"	"(ft/sec)"
1.7,	99.999,	.935,	1.622

"Initial Mix Values for Segment 1"

"Flow"	"DO"	"cBOD"	"nBOD"	"DOSat"	"Temp"
"(mgd)"	"(mg/l)"	"(mg/l)"	"(mg/l)"	"(mg/l)"	"deg C"
98,	7.572,	9.184,	2.121,	8.573,	22

"Rate Constants for Segment 1. - (All units Per Day)"

"k1",	"k1@T",	"k2",	"k2@T",	"kn",	"kn@T",	"BD",	"BD@T"
1,	1.096,	10.588,	11.103,	.35,	.408,	0,	0

"Output for Segment 1"
"Segment starts at MARTINSVILLE STP"

"Total" "Dist."	"Segm." "Dist."	"DO"	"cBOD"	"nBOD"
"(mi)"	"(mi)"	"(mg/l)"	"(mg/l)"	"(mg/l)"
0,	0,	7.572,	9.184,	2.121
.1,	.1,	7.573,	9.146,	2.118
.2,	.2,	7.574,	9.108,	2.115
.3,	.3,	7.575,	9.07,	2.112
.4,	.4,	7.576,	9.033,	2.109
.5,	.5,	7.577,	8.996,	2.106
.6,	.6,	7.578,	8.959,	2.103
.7,	.7,	7.579,	8.922,	2.1
.8,	.8,	7.581,	8.885,	2.097
.9,	.9,	7.583,	8.848,	2.094
1,	1,	7.585,	8.812,	2.091
1.1,	1.1,	7.587,	8.776,	2.088
1.2,	1.2,	7.589,	8.74,	2.085
1.3,	1.3,	7.591,	8.704,	2.082
1.4,	1.4,	7.593,	8.668,	2.079
1.5,	1.5,	7.595,	8.632,	2.076
1.6,	1.6,	7.597,	8.596,	2.073
1.7,	1.7,	7.599,	8.561,	2.07

"END OF FILE"

REGIONAL MODELING SYSTEM VERSION 4.0

Model Input File for the Discharge to SMITH RIVER.

File Information

File Name:	C:\Users\pvu61777\Documents\000_kaharlow\Martinsville_STP - VA00253
Date Modified:	January 10, 2014

Water Quality Standards Information

Stream Name:	SMITH RIVER
River Basin:	Roanoke River Basin
Section:	3g
Class:	IV - Mountainous Zones Waters
Special Standards:	None

Background Flow Information

Gauge Used:	Martinsville STP Effluent
Gauge Drainage Area:	390 Sq.Mi.
Gauge 7Q10 Flow:	90 MGD
Headwater Drainage Area:	0 Sq.Mi.
Headwater 7Q10 Flow:	90 MGD (Net; includes Withdrawals/Discharges)
Withdrawal/Discharges:	0 MGD
Incremental Flow in Segments:	0.2307692 MGD/Sq.Mi.

Background Water Quality

Background Temperature:	22 Degrees C
Background cBOD5:	2 mg/l
Background TKN:	0 mg/l
Background D.O.:	7.711252 mg/l

Model Segmentation

Number of Segments:	1
Model Start Elevation:	660 ft above MSL
Model End Elevation:	630 ft above MSL

REGIONAL MODELING SYSTEM VERSION 4.0

Model Input File for the Discharge to SMITH RIVER.

Segment Information for Segment 1

Definition Information

Segment Definition:	A discharge enters.
Discharge Name:	MARTINSVILLE STP
VPDES Permit No.:	VA0025305

Discharger Flow Information

Flow:	8 MGD
cBOD5:	22.5 mg/l
TKN:	9 mg/l
D.O.:	6 mg/l
Temperature:	22 Degrees C

Geographic Information

Segment Length:	1.7 miles
Upstream Drainage Area:	0 Sq.Mi.
Downstream Drainage Area:	0 Sq.Mi.
Upstream Elevation:	660 Ft.
Downstream Elevation:	630 Ft.

Hydraulic Information

Segment Width:	99.999 Ft.
Segment Depth:	0.935 Ft.
Segment Velocity:	1.622 Ft./Sec.
Segment Flow:	98 MGD
Incremental Flow:	0 MGD (Applied at end of segment.)

Channel Information

Cross Section:	Rectangular
Character:	Mostly Straight
Pool and Riffle:	No
Bottom Type:	Sand
Sludge:	None
Plants:	None
Algae:	None

Attachment G

Historical Limit Development

MEMORANDUM

State Water Control Board

2111 North Hamilton Street | P. O. Box 11143 | Richmond, VA. 23230

SUBJECT: Smith River Water Quality Management

TO: R. G. Burnley

FROM: W. H. Bishop

DATE: January 29, 1986

COPIES: W. L. Woodfin-DWRPM, L. G. Lawson-OWRM, M. G. Ferguson-OWRM, D. F. Jones-OWRP, M. D. Phillips-OERS, A. J. Anthony-OERS,

INTRODUCTION

The Henry County PSA has submitted an NPDES Application for a new 4.0 MGD sewage treatment plant to serve southern Henry County. The plant will be located 3.4 miles downstream of the existing 6.0 MGD City of Martinsville STP. Previous plans called for expansion of the Martinsville STP to 8.0 MGD together with an expansion of the 4.0 MGD Henry County Upper Smith River (USR) STP to 8.0 MGD. The USR facility is located approximately 6.0 miles upstream of the Martinsville STP. The only other major discharge in this segment is the 1.5 MGD E. I. du Pont facility.

Attached as Figure #1 is a map of the Smith River from the Upper Smith River STP to the Eden, North Carolina Water Treatment Plant. Besides the 3 discharges noted above this segment contains two impoundments 1) Philpott (COE) and 2) City of Martinsville Hydro Project. Both impoundments operate for power generation and provide flood control. Neither is regulated nor is any flow through required. This situation is one of the principal reasons this segment cannot be effectively modeled. To compound this issue the release from Philpott is a bottom withdrawal of very cold water for trout propagation which increases the modeling variables. Modeling possibilities within this segment have been previously considered by OERS personnel (formerly BWCM) and rejected.

Even if modeling for oxygen demanding substances is possible, a number of other parameters which cannot be modeled must be studied for permit consideration. North Carolina has already objected to the existing discharges in this segment, principally Martinsville, in order to protect the Eden water supply approximately 13.5 miles below the Martinsville STP. Details of North Carolina's complaints and the WCRO response are contained in a staff report entitled "Water Quality of the Smith River" dated September, 1985. This report was previously transmitted to OERS and OWRM. Excerpts as necessary are attached.

E-1, 1

NC has complained of taste and odor problems at the Eden water intake and has asked Virginia to place tighter controls on TDS (Total Dissolved Solids), chlorides, conductivity, and phenols. As the staff report indicates, the Martinsville STP is the source of elevated levels of the above parameters although standards are not routinely violated. There are serious questions based upon data supplied by NC that usage of our Public Water Supply (PWS) standards for control of these parameters will relieve the taste and odor problems at Eden.

Recently Eden has complained that the river color is causing color in the finished water. As a result the water treatment plant has had to be shut down for short periods. No taste and odor or chlorine demand was associated with these complaints. In addition, these complaints have come on Sunday and Monday rather than Tuesday. Tuesday Complaints just ahead of the Philpott power slug generated on Monday morning have been the norm. No power is generated on weekends as a rule.

In addition to the individual parameters, "toxics" concerns at the Martinsville STP are well documented. Under the newly proposed treatment scheme a large percentage of the industrial waste being treated by the Martinsville STP will be transferred to the new plant tentatively named Lower Smith River (LSR).

PREVIOUS PLANNING

The Roanoke River Basin (303(e)) Plan originally utilized the TVA Flat Water Equation to calculate assimilative capacities. However, it was recognized that the flow, slopes, and temperatures in this segment were not applicable to that method of determining assimilative capacities. In 1982 the Board approved Amendment #4 to the 303(e) Plan to allow expansion of the Martinsville STP to 8.0 MGD (from 6.0 MGD) and the Henry County Upper Smith River (USR) to 8.0 MGD (from 4.0 MGD).

The approved allocations are listed below. The concentrations cited are for 8.0 MGD.

	STP	Allocation	Allowable Effluent Concentration of Design Flow
1.	Martinsville	1500 lbs/d	24 mg/l
	USR	1134 lbs/d	17 mg/l
	E.I.du Pont	503 lbs/d	

VIRGINIA WATER CONTROL BOARD

File

MEMORANDUM

P. O. Box 7017 Roanoke, Virginia 24019

SUBJECT: Lower Smith River

TO: Robert G. Burnley, Regional Director, WCRO

FROM: William H. Bishop, Regulatory Services-WCRO

William H. Bishop, Jr.

DATE: May 30, 1986

COPIES:

The limits below are proposed for the Lower Smith River STP's draft permit. The rationale for the limits follows. Additionally, future considerations for the Martinsville STP are also included due to the need to allocate the streams assimilation capacity between these two discharges.

	Lower Smith River	Martinsville (Future)
Flow -	4.0 MGD	8.0 MGD
BOD -	17 mg/l	22.5 mg/l
TSS -	30 mg/l	30.0 mg/l
Cl_2 -	0.21 mg/l	0.09 mg/l
D.O. -	4.5 mg/l	- -
Color -	60 units	172
TDS -	3630 mg/l	3630
Chlorides-	1815 mg/l	1815
MBAS -	4.13 mg/l	4.13
Phenols -	8.3 ug/l	8.3 ug/l
Sulfates -	2,065 mg/l	2,065 mg/l

Flow - The existing permit application is for a 4.0 MGD discharge. Future consideration of 6.0 MGD is being addressed for all parameters except flow. Since flow is not an actual NPDES permit limitation, 6.0 MGD could be discharged without permit modification if all other limits are met. The Board will still have some options for flow control under the "Policy for Sewage Treatment Plant Loadings".

BOD - As has been discussed in several briefing memos, there is no model available at this time to estimate the assimilative stream capacity. The TVA Flat Water Equation was used in the Roanoke River Basin Water Quality Management Plan for estimating purposes. Inputs to the Smith River currently include an allocation of 1500 lbs/D BOD for the Martinsville STP, 1134 lbs/D for the Henry County Upper Smith River STP, and 500 lbs/D for the DuPont STP.

This permit reallocates 1/2 of the Upper Smith River STP allocation to the Lower Smith River STP. This reallocation will be conditioned upon the maintenance of stream standards. A permittee operated monitoring program will be used to verify water quality. The Roanoke River Basin Water Quality Management Plan is being simultaneously revised to allow this reallocation. If an appropriate model is successfully run on this stream segment, the WQMP and this permit will have (X) to be revised.

E-1, 3

TSS - There are no water quality limits associated with TSS. A technology minimum for POTW's of 30 mg/l has been assigned.

Cl_2 - These limits are based upon the Board's currently proposed standard of 11 ug/l. Complete mix and no background residual are assumed. The county has discussed relief from this control for the USR STP based upon the lack of measurable residuals below the outfall. Relaxation of this limit will probably be requested by the county for this discharge as well.

D.O. - To satisfy non-degradation a D.O. drop of no more than 0.2 mg/l at the mix point was used. An effluent D.O. of 3.3 mg/l is needed at 4.0 MGD and 4.5 at 6.0 MGD for the Lower Smith River to maintain this standard. Usage of the 6.0 MGD allocation provides the county with a realistic design objective. It is possible that no actual post aeration equipment will be requierd to meet this D.O. level.

The Martinsville STP has no D.O. limit although it does have post aeration. A file search to provide background on this issue will be conducted as soon as possible.

Color - Based upon the recommendation of the State Department of Health, a limit of 15 color units in-stream is being considered for permit preparation. This agrees with the Water Quality Standards allowance for use of potable water limits if conventional water treatment does not remove the pollutants in question.

Since the River Basin Section Table for Section 3g, PWS, just below the discharge does not indicate any special limitations, the standard intake limits for protection of a Surface Public Water Supply will be used. To determine intake limits at Eden the 7 day/10 year low flow at the Fieldcrest Mills water intake at Eden has been utilized. The Smith River USGS gage is located very near this intake and will be used as the intake point. The 7 day/10 year low flow at Eden is 157.7 cfs and at Martinsville, it is 109 cfs. The 1 day/20 year low flow at Eden is approximately 1/2 of the 7 day/10 year flow. On that rare occasion, Fieldcrest Mills will have to improve treatment or purchase water from Eden.

The following mass balance has been used to determine discharge concentrations for each conservative pollutant under consideration including color.

Eq #1

$$C_s Q_s = C_1 Q_1 + C_2 Q_2 + C_3 Q_3 + C_4 Q_4$$

C_s = concentration at Eden
C_s = flow at Eden (101.7 MGD + C_1 + C_2)
C_1 = concentration of #1 discharge
C_1 = flow of #1 discharge
C_2 = concentration of #2 discharge
C_2 = flow of #2 discharge
C_3 = background concentration
C_3 = background flow
C_4 = concentration of additional flow in stream between Martinsville and Eden.
Q_4 = additional flow between Martinsville and Eden.

(X)

E-1, 4

Color Calculation Inputs and Outputs

Case #1

$C = 15$ c.u. $C_1 = 60$ $C_2 =$ $C_3 = 0$ $C_4 = 0$

$Q_s = 101.7$ MGD $Q_1 = 4.0$ MGD $Q_2 = 6.0$ MGD $Q_3 = 70.3$ MGD $Q_4 = 31.4$ MGD

$(101.7 + 6.0 + 4.0)15 = 60(4) + 6C_2 + 0 + 0$

$C_2 = 239$ c.u.

Case #2

$Q_1 = 6.0$ MGD
$Q_2 = 6.0$ MGD
$C_2 = 224$ Color Units (c.u.)

Case #3

$Q_1 = 6.0$ MGD
$Q_2 = 8.0$ MGD
$C_2 = 172$ Color Units (c.u.)

Case #3 displays a future (8.0 MGD) color concentration for the Martinsville STP of 172 c.u. and allows a concentration of 60 c.u. at 6.0 MGD for the Lower Smith River STP. This approach sets a technology limit of 60 c.u. for new facilities. The 6.0 MGD used above allows reserve for some future expansion of the Lower Smith River facility.

The remainder of the color is allocated to the City of Martinsville. The concentration of 172 units is recommended for all flow levels. No appreciable cost differential is anticipated to achieve 172 units versus 224 units. If a cost differential is discovered, a new allocation rationale may have to be developed.

Modifications due to cost may not impact upon the 60 c.u concentration at the Lower Smith River facility. Martinsville could be allowed a tiered permit until it reaches 8.0 MGD although this is not a desirable approach from an operational or regulatory view point. In addition, if appreciable background exist in the future, a reallocation including the Upper Smith River and DuPont may have to be considered.

TDS - Eg #1 will be employed again. However, no technology limit is assumed. Background TDS currently exist considerably less than 100 mg/l. 100 mg/l is still recommended to allow a future reserve and a margin of safety in the downstream allocation. The current background data is not at low flow.

(X)

The following inputs were used for determining this allocation

Case #4

$C_s = 500$ $C_1 = C_2 = C$ $CS = 100$ $C_4 = 0$

$Q_s = 101.7$ $Q_1 = 4.0$ $Q_2 = 6.0$ $Q_3 = 70.3$ $Q_4 = 31.4$

C = 4,880 mg/l

Case #5

$Q_1 = 6.0$ MGD

$Q_2 = 6.0$ MGD

C = 4,150 mg/l

Case #6

$Q_1 = 6.0$ MGD

$Q_2 = 8.0$ MGD

C = 3630 mg/l

Case #4 illustrates the necessary controls to put on the Martinsville STP and Smith River STP at immediate conditions to satisfy the Public Water Supply Standard of 500 mg/l TDS using 100 mg/l TDS background.

Case #5 and #6 were calculated to display the limitations considering future growth. Case #6 is recommended for design of the LSR STP and for permit limitations. If the background concentration increases unexpectedly, future modification to this limitation will be necessary.

Chlorides - For chlorides, a downstream concentrate of 250 mg/l is required. A background concentration of 50 mg/l is conservatively estimated. Using these concentrations, the chloride limitation is exactly 1/2 of the TDS.

Chlorides = 1815 mg/l

Chromium (Total), Copper, Foaming Agents (MBAS), Phenols, Sulfates, and Zinc may also be in this wastewater. Using the PWS standards and the same rationale as used for calculating limits of TDS and chlorides, the above parameters were examined. No background was assumed. The following levels of discharge were estimated based upon a discharge of 6.0 MGD from the LSR and 8.0 MGD from the Martinsville STP

(X)

The following levels of discharge were estimated based upon a discharge of 6.0 MGD from the LSR STP and 8.0 MGD from the Martinsville STP.

	In-Stream (mg/l)	Effluent Concentrations for LSR = 6.0 MGD and Martinsville = 8.0 MGD
Chromium	0.05	410 ug/l
Copper	1.00	8.26 mg/l
Foam	0.50	4.13 mg/l
Phenols	.001	8.3 ug/l
Zinc	5.0	41.3 mg/l
Sulfates	250	2,065 mg/l

Based upon the river monitoring program, a limit on phenols of 8.3 ug/l is recommended. Additionally, given the past history of foam on the Smith River, a limit on MBAS of 4.1 mg/l is recommended. Sulfate limits are recommended due to the type of industry being serviced. There is no indication of any need to limit any of the other parameters.

Quantities

All the above concentrations were converted to quantities (or equivalents) based upon a flow of 4.0 MGD at the Lower Smith River STP. This approach allows an acceptable margin of safety. A final recommendation to allocate the remainder of the stream capacity to the Lower Smith River when expanded to 6.0 MGD will be judged against the information on hand at that time.

TMPs

If these limits prove to cause toxicity problems, the Water Quality Standards would allow further modifications of the limits. Chromium, copper, and zinc are included in the State Water Control Board's Water Quality Criteria and may be appreciably lower than the PWS limits.

WHB/vcm

(X)

standards for application to specific drinking water sources. Because some pollutants are not significantly removed by conventional water treatment systems, and to insure protection of the water supply, the stream standards for those pollutants are the same as the limits required for protection of public health in the finished drinking water.

In order to emphasize the need to protect a specific body of water for use as a source for a public water supply, each such area has been designated as a separate section in the River Basin Section Tables of Section 4. The section usually begins at the intake point and usually extends 5 miles upstream. (If a watershed is not significantly larger than 5 miles above the intake the water supply section may include the entire upstream watershed to its headwaters.) This designation as a separate section is primarily an administrative method of pointing out a water supply source and emphasizing the need to protect the stream.

The public water supply standards usually apply only at the raw water intake point. Of course, the upstream water quality must be such that specific limits will be met at the intake point. In cases where the specific numeric limits are adopted to apply for some additional upstream distance to provide further protection for the water source, the section description in the River Basin Section Tables will indicate this fact and point out the additional distance. Lacking such special notation, the public water supply standards apply only at the intake point.

Public Water Supply Standards and Protection of Aquatic Life

The Public Water Supply Standards are designed to protect water quality for human consumption. These limits, however, in some cases may not be sufficient to protect aquatic life. Many aquatic organisms are more sensitive to certain pollutants than humans and would, of course, be under constant exposure to any such pollutant in their environment. Therefore, when the Board considers classifying a body of water as a public water supply, an evaluation of the aquatic community in that area is made to determine if water quality concentration limits must be more stringent for any particular parameter to protect the aquatic community. (The concentrations for those pollutants that are marked with an asterisk (*) are the ones most likely to be too high to protect aquatic life, although adequate to provide protection for human consumption.) This procedure will ensure that any specific numeric limits adopted as enforceable standards for a public water supply will be stringent enough to protect aquatic life.

2.03 Surface Water Standards for Surface Public Water Supplies

In addition to other standards established for the protection of public or municipal water supplies, the following standards will apply at the water intake and, if determined to be appropriate, for a distance upstream, and in the case of the streams influenced by tidal action, downstream also. This distance from the intake is to be determined on a case-by-case basis by the Board considering upstream wastewater volume, receiving stream volume and other appropriate physical, chemical and biological factors. The standards will apply to both the water supply stream and its tributaries within the designated distance. (In case of existing water supplies, the standards will apply at the intake point until further change is made.)

CONSTITUENT	CONCENTRATION (MG/L)
Arsenic	0.05
Barium	1.0
Cadmium*	0.01
Chloride	250
Chromium (Total)	0.05
Copper*	1.0
Foaming agents (measured as methylene blue active substances)	0.5
Iron (soluble)	0.3
Lead	0.05
Manganese (soluble)	0.05
Mercury*	0.002
Nitrate (as N)	10
Phenols	0.001
Selenium*	0.01
Silver*	0.05
Sulfate	250
Total dissolved solids	500
Zinc*	5.0

E-1, 8

Subject: Smith River - 2 Color Units ✓

To: Bob Burnley

From: W. H. Bishop

9-16-86

cc: A. Hammer, W. L. Woodfin

Assumed:

1. EDEN Low flow - 101.7 MGD
2. LSR Discharge - 6.0 MGD
3. MART Discharge - 8.0 MGD
4. No Background

Equal Allocation

LSR Conc. = MART. Conc. = 200 C.U.

Flow Proportional

LSR Conc = 231 cu.

MART Conc = 173 c.u.

Verify:

1. 231 (6) - 173 (8)

1386 ≈ 1384

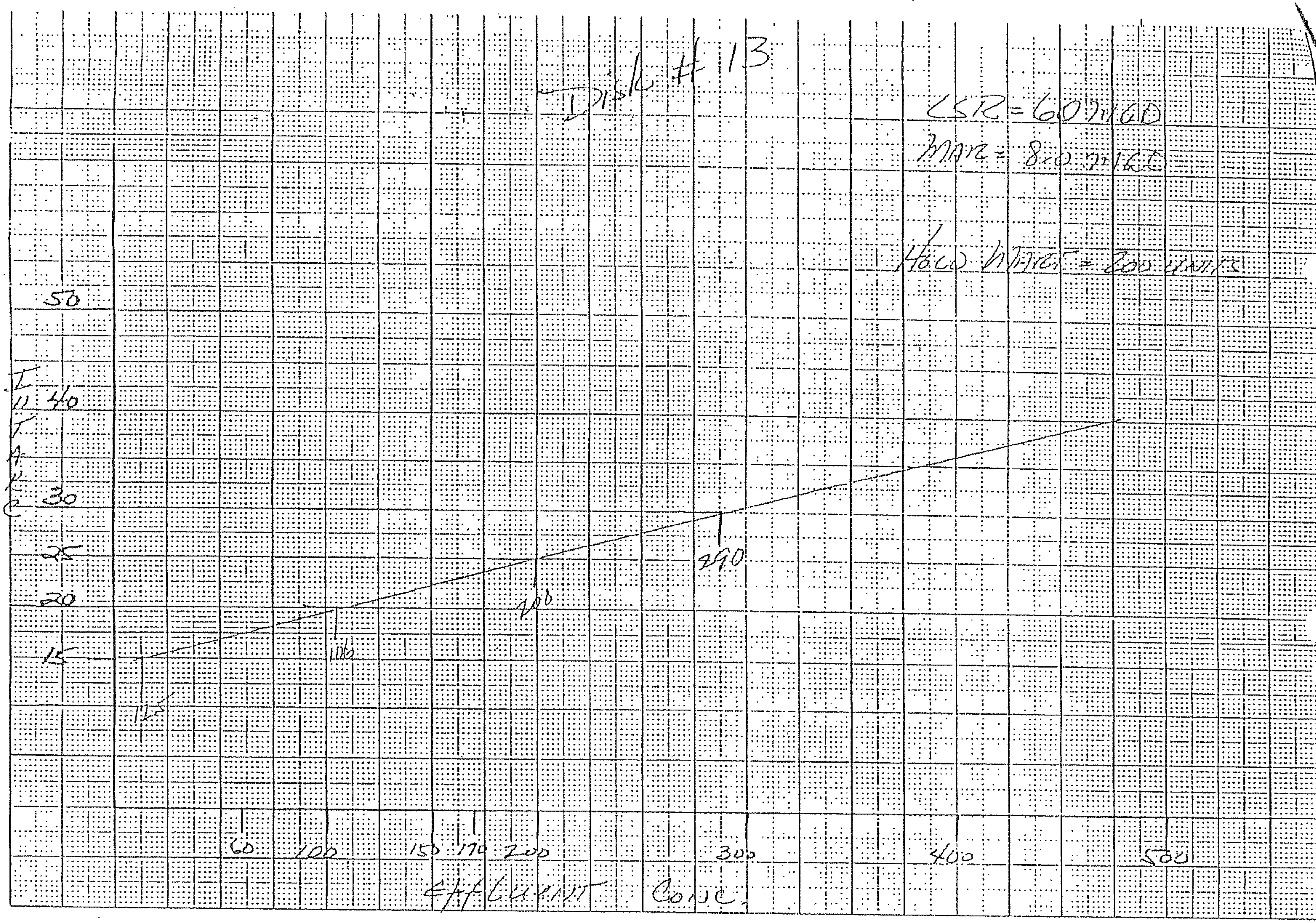
2. Equal Allocation agrees with J. Warwick's letter of 7-25-86.

* NOTIFIED WLW 9-16-86

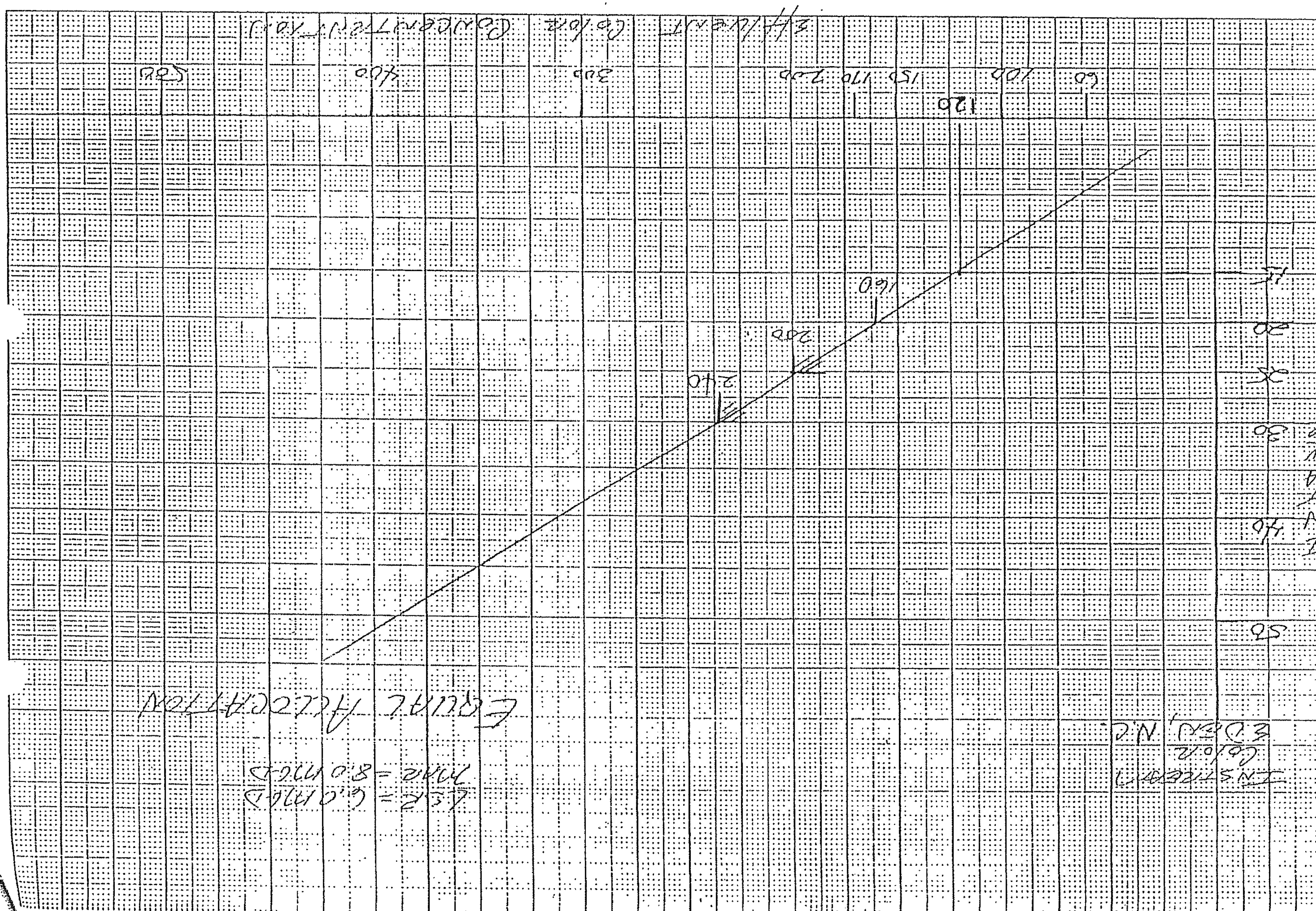
** J. WARWICK To submit 24 hr. RATIONALE by 9-17-86

Assume delivery 9-18-86

E-1,9



K&E 10 X 10 TO THE CENTIMETER 18 X 25 CM. KEUFFEL & ESSER CO. MADE IN U.S.A. 46 1510



APPENDIX III-1 (Cont.)

PART C

Part C is to be used to record changes in the permit (1) from the previously issued permit and/or (2) during the permit processing period.

NPDES PERMIT PROGRAM
Permit Processing Change Sheet

1. Effluent Limits and Monitoring Schedule: (List any changes and give a brief rationale for the change).

Outfall No.	Parameter Changed	Monitoring Limits Changed From	To	Rationale	Date and Initial
001	Color	NA	200		
	MBAS	NA	93.75 Kg/D	ATTACHMENT C	
	TDS	NA	82,000 Kg/D		
	Chlorides	NA	41,000 Kg/D		
	Sulfates	NA	46,900 Kg/D		
	Phenols	NA	0.19 Kg/D		
	Chlorine Residual	LO	0.1 mg/L		
		at	6.0 MGD		

001	Color	NA	200 *	ATTACHMENT E	MARTINSVILLE STP @ 8.0 MGD
	MBAS	NA	125 Kg/D		
	TDS	NA	110,000 Kg/D		
	Chlorides	NA	55,000 Kg/D		
	Sulfates	NA	62,500 Kg/D		
	Chlorine Residual	1.0	0.1 mg/L		

*INCREASE TO 300 ADMI IN 1996 BASED ON JUSTIFICATION PROVIDED BY PERMITTEE

9-VAC-25-430-et.

PROPOSED AMENDMENT TO THE ROANOKE RIVER BASIN 303(e) WATER QUALITY MANAGEMENT PLAN

Part 1 of 4 Chapter IV "Stream Loading Capacities, Section C. Waste Load Allocations and Suggested NPDES Permit Numbers", Table 21 titled "Loadings and Allocations for Significant Dischargers for Selected Alternative Roanoke River Basin Water Quality Management Plan" pages 221 and 222.

	Date 1982 through 2020
WQMA X11 Study Area: Smith River Upper Smith River STP	
Design Flow (mgd)	~~8.0~~ 4.0
*BOD_5 (lbs/day)	~~1,184~~ 567
*Suspended Solids (lbs/day)	~~1,184~~ 567
*Nitrogen (lbs/day)	
*Phosphorus (lbs/day)	
WQMA X11 Study Area: Smith River E. I. DuPont[1]	
Design Flow (mgd)	N/A
*BOD_5 (lbs/day)	503
*Suspended Solids (lbs/day)	541
*Nitrogen (lbs/day)	
*Phosphorus (lbs/day)	

PROPOSED AMENDMENT TO THE ROANOKE RIVER BASIN 303(e) WATER QUALITY MANAGEMENT PLAN

WQMA X11	
Study Area: Smith River	
Martinsville STP	
Design Flow (mgd)	8.0
*BOD_5 (lbs/day)	1,500
*Suspended Solids (lbs/day)	1,500
*Nitrogen (lbs/day)	
*Phosphorus (lbs/day)	

(Add the following entry)

WQMA X11	
Study Area: Smith River	
Lower Smith River STP	
Design Flow (mgd)	4.0
*BOD_5 (lbs/day)	567
*Suspended Solids (lbs/day)	1,000
*Nitrogen (lbs/day)	
*Phosphorus (lbs/day)	

Notes:

* Presented in this table are the existing waste loads and future allocations. BOD_5 is the only constituent for which allocations are established, other major components are presented as suggested NPDES Permit numbers. Please refer to page 210, Part 1 of 4; Roanoke River Basin, Water Quality Management Plan for further text.

* Includes all facilities.

Part 3 of 4 Chapter VI "Water Quality Management Plan, Smith River Study Area" page 788. Omit the second paragraph (shown below).

~~Based on the above analysis, previous reports, and local opinion, alternative #2 is the selected plan at the City of~~

E-2, 2

Attachment H

TMP Justification Memorandum

MEMORANDUM

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
WEST CENTRAL REGIONAL OFFICE

3019 Peters Creek Road Roanoke, VA 24019

SUBJECT: TMP for Permit Reissuance for Martinsville STP - VA0025305

TO: Permit File

FROM: Kevin Harlow, BRRO

DATE: January 6, 2014

General Information

The City of Martinsville Sewage Treatment Plant (STP) is an extended aeration secondary treatment plant that has a monthly average design flow of 8.0 MGD. The plant discharges to the Smith River.

The current permit requires annual monitoring using a 24-hour flow proportioned composite sample of final effluent from Outfall 001 with Ceriodaphnia dubia used as the test species. Additional monitoring was conducted for required permit application data. The additional monitoring included both acute and chronic monitoring using both Ceriodaphnia dubia and Pimephales promelas. The collected data indicates a lack of toxicity during the 2009 permit term.

C.dubia

Date	LC50	A-NOEC	C-NOEC	C-LOEC	Hardness
Aug-09	>100%	100%			
Aug-10	>100%	100%			102
Nov-10	>100%	100%	100%	>100%	118
Aug-11	>100%	100%			98
Sep-11	>100%	100%	100%	>100%	93
Oct-11	>100%	100%	100%	>100%	68
Feb-12	>100%	100%	100%	>100%	160
Aug-12	>100%	100%			114

P.promelas

Date	LC50	A-NOEC	C-NOEC	C-LOEC	Hardness
Nov-10	>100%	100%	100%	>100%	118
Sep-11	>100%	100%	100%	>100%	93
Oct-11	>100%	100%	100%	>100%	68
Feb-12	>100%	100%	100%	>100%	160

Recommendations - Biological Testing

Outfall 001

It is recommended that TMP monitoring continue with both chronic and acute WET testing using both Ceriodaphnia dubia and Pimephales promelas in four annual samples. This will create monitoring data during the permit term while also generating the required data for the next permit application.